ABSTRACTS OF NORTH AMERICAN GEOLOGY

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WALTER J. HICKEL, *Secretary*

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William T. Pecora, *Director*

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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports of memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

The numbers assigned to the abstracts in this publication are for reference in using the index; they are not order numbers. Publications cited here in abstract form are available in most geological libraries or through interlibrary loan.

Abstracts of North American Geology and the Bibliography are prepared by use of computer techniques. Each abstract, along with its indexing, is placed on magnetic tape and entered into a permanent data bank. The material prepared each month is published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

A list of journals commonly cited in Abstracts of North American Geology may be obtained by writing to the U.S. Geological Survey, Washington, D. C. 20242. Serial publications cited for the first time are as follows:

[France] Office Recherche Sci. et Tech. Outre-Mer Cahiers, Ser. Pedologie—Office de la Recherche Scientifique et Technique Outre-Mer Cahiers, Serie Pedologie. Paris, France.

Nebraska Geol. Survey Paper—Nebraska Geological Survey Paper. The University of Nebraska Conservation and Survey Division. Lincoln, Nebr.

Smithsonian Contr. Paleobiology—Smithsonian Contributions to Paleobiology. Smithsonian Institution. Washington, D.C.

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ABSTRACTS

Abdel-Hady, Mohamed. *See* Matalucci, Rudolph V. 00909

00507 **Alyer, Arunachalam Kulathu.** An analytical study of the time-dependent behavior of underground openings [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3159B, 1970.

00834 **Aki, Keiiti.** Geophysics, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 91-113, illus., 1970.

The dislocation theory of an earthquake source may be used for predicting seismic acceleration spectra. At least eight source parameters are needed for describing an earthquake dislocation. They are strike direction, dip angle, slip angle, fault length, fault width, amount of dislocation, rupture velocity, and rise time. An example of synthesizing acceleration from these parameters is given using strong motion records of the Parkfield earthquake of 1966. The most important future problem of engineering seismology is to construct a world map showing distribution of the above parameters. — *from* Author's abstract

00666 **Alberstadt, Leonard P.; Maniatis, Jessie; Moore, Nelson K.** Carbonate rock types of the Middle and Upper Ordovician formations in the central basin of Tennessee [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 191, 1970.

00667 **Alberstadt, Leonard P.** Some Middle and Upper Ordovician brachiopods from Oklahoma, Missouri, and Tennessee [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 191-192, 1970.

08396 **Alder, B.; Geiss, J.; Groegler, N.; Renaud, A.** Gas composition in ice samples collected by E.G.I.G. in Greenland, *in* Etudes physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 100-107, illus., tables, 1969.

Twelve ice samples from a site on the western edge of the Greenland Icecap were measured by mass spectometry for N_2, O_2 and Ar gas content. Results were compared with those of similar tests on samples from other sites on the icecap. No correlation with depth or altitude was found. All samples, except those from superimposed ice, showed Ar/N_2 and O_2/N_2 ratios lower than those in air, a finding which differed noticeably from those of previous investigations. The relationship observed between the two ratios suggests that gas solubility in water is a determining factor. — EH

00860 **Aldrich, Merritt J., Jr.** Stress orientation during uplift of basement rocks [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 266, 1970.

00825 **Alford, Donald.** Mass-balance studies — Grasshopper Glacier, Montana: Arctic and Alpine Research, v. 2, no. 1, p. 75-79, illus., tables, 1970.

Mass-balance studies, based primarily on the determination of net mass balance as indicated by a network of point measurements on the surface of Grasshopper Glacier, were begun in 1967. In 1967, a specific mass balance of 0.81 m of water equivalent was measured; in 1968, this value dropped to 0.53 m. This positive mass balance during the 2 years of study appears to be primarily related to local topoclimatological controls. — Author's abstract

Alger, R. P. *See* Tixier, M. P. 00962

08419 **Allaart, J. H.; Bridgwater, D.; Henriksen, N.** Pre-Quaternary geology of southwest Greenland and its bearing on North Atlantic correlation problems, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 859-882, illus., tables, 1969.

Two major divisions of Precambrian plutonic rocks are present in West Greenland south of lat 62°30′ N. The oldest (pre-Ketilidian) rocks, 2,500-2,700 m.y. old, are in the north. At about lat 61°15′ N., these are overlain unconformably by Ketilidian metasedimentary and metavolcanic rocks. Southward there is evidence of increasing deformation and plutonism in the Ketilidian mobile belt, which exhibits two plutonic episodes: the main Ketilidian at 1,800 m.y. (?) and the Sanerutian with intrusives dated between 1,500 and 1,640 m.y. The subsequent Gardar period was marked by major faulting, deposition of continental sand and volcanic rocks, and by alkalic magmatism 1,000 to 1,300 m.y. ago. Middle to late Phanerozoic basic dikes are the only post-Gardar-pre-Quaternary event recognized. Correlations between southwestern Greenland and Labrador are suggested; those between Greenland and Scotland are less well founded. — VSN

00501 **Allan, Roderick James.** Clay mineralogy and geochemistry of soils and sediments with permafrost in interior Alaska [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 2984B-2985B, 1970.

00812 **Allen, Joe H.; Bailey, Leslie F.** Earthquakes and nuclear detonations: Science, v. 167, no. 3920, p. 1012, 1970.

In addition to the seismic activity resulting from nuclear detonations the creation of large areal surface loads by the back-filling of lakes behind man-made dams is discussed. Examples of earthquake activity associated with these stresses are cited. The suggestion that periodic detonation of high-yield, deeply buried nuclear devices be used to release accumulated seismic stresses in tectonically active areas is considered. In view of the diffculty in decreasing seismic stress by frequent small earthquakes, and the lack of assurance that setting off a large underground explosion in a tectonically unstable area such as the San Andreas fault zone might not yield an aftershock of one or two units magnitude greater than the trigger device it is suggested that this idea is not advisable. — GV

00969 **Anders, Edward; Heymann, Dieter; Mazor, Emanuel.** Isotopic composition of primordial helium in carbonaceous chondrites: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 127-131, illus., table, 1970.

The He-3/He-4 ratio of primordial He in carbonaceous chondrites varies with the Ne-20/Ne-22 ratio, according to the relation: $\text{He-3/He-4} = (6.87 \pm 0.72) \times 10^{-5}$ (Ne-20/Ne-22) - $(4.38 \pm 0.76) \times 10^{-4}$. Apparently primordial He, like Ne, consists of at least two distinct components, of $\text{He-3/He-4} = (1.25 \pm 0.76) \times 10^{-4}$ and $(4.20 \pm 0.76) \times 10^{-4}$. — Authors' abstract

08408 **Anderson, A.; Wong, L. Y.** Crystal field splitting in the far infrared spectrum of rhombic sulfur: Canadian Jour. Chemistry, v. 47, no. 14, p. 2713-2715, illus., table, 1969.

The infrared (i.r.) spectra of thin polycrystalline samples of orthorhombic sulfur at 95°K in the range 50-500 cm^{-1} have been recorded. The three i.r. active fundamentals ν_4, ν_3, and ν_4 are observed to be split into 2, 3, and 3 components, respectively, as predicted from a group theoretical analysis of the unit cell symmetry, thus confirming the assignment of ν_4 and ν_4. Several weaker absorptions are assigned by comparison with recent Raman results and a normal coordinate analysis. No peaks assignable to lattice vibrations are observed. — Authors' abstract

00811 **Anderson, Don L.; Archambeau, Charles B.; Brune, James N.; Richter, Charles F.; Smith, Stewart W.** Earthquakes and nuclear detonations: Science, v. 167, no. 3920, p. 1011-1012, 1970.

The correlation by Emiliani and others (1969) of seismic events out to 860 km from the Nevada test shots is questioned on the grounds that the list of seismic events used to establish this correlation represents no more than 30 percent of the information available in print and a much smaller percentage of the earthquakes known to have occurred in the area. It is noted that two significant tests have been neglected: (1) incidence of earthquakes in 8-hour intervals following the nuclear tests should be compared with incidence in corresponding intervals proceding them, and (2) the entire counting process should be repeated after dates and hours when no shots were fired, selected systematically. — GV

00815 **Anderson, Dwayne M.; Brown, Jerry.** Bentonite landslides [reply to discussion by D. B. Prior and C. Ho of 1969 paper]: Science, v. 167, no. 3920, p. 1015, 1970.

In this reply to Prior and Ho's comment (ibid., p. 1014-1015) on the original paper (ibid., v. 164, no. 3876, p. 173-174), it is stated that it was not the intent of that paper to imply that all bentonite-rich mud flows are unique to the Arctic. What is suggested to be unique about the flows near Umiat has to do with channel morphology, the relation between slope angle and the flow regime, the frequency of flow activity, and the density of the flow channel distribution on permafrost-underlain terrain. Although climatic factors are not dominant over geologic aspects in governing mud- and debris-flow regimes, it is maintained that the frequency and morphology presented by bentonite debris flows when they occur over permafrost are sufficiently distinctive that, on aerial photographs, bentonite debris flows may be differentiated from other types of flows with considerable reliability. — GV

Anderson, Garry G. *See* Huffman, Samuel F. 00721

00593 **Anderson, John B.** Stratigraphy of the western margin of the Nacimiento uplift, New Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 324, 1970.

00861 **Antoine, John W.; Pyle, Thomas E.** Crustal studies in the Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 266-267, 1970.

Archambeau, Charles B. *See* Anderson, Don L. 00811

00838 **Arias, Arturo.** A measure of earthquake intensity, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 438-483, illus., tables, 1970.

Shortcomings of the various earthquake intensity scales are pointed out and a new scale is proposed, based on energy dissipation of a statistical population of structures, which provides a measure of seismic destructiveness. One of the advantages of the new technique is that once the accelerograms for three mutually perpendicular directions through a point are known, the intensity can be computed in any direction through that point. — BFG

00566 **Armstrong, Richard Lee.** Mantled gneiss domes in the Albion Range, southern Idaho — A revision: Geol. Soc. America Bull., v. 81, no. 3, p. 909-910, 1970.

Revision of stratigraphy in the area is suggested on the basis of further field observations. The Harrison Summit Quartzite has proven to be upside down and thus its lower contact is tectonic and its age and correlation still uncertain. The metamorphic fabric is continuous across the tectonic contact indicating that the allochthonous formations overlying the gneiss domes were emplaced before or during the regional metamorphism. — AH

00862 **Aronow, Saul.** Regional contrasts in the deterioration of relict fluvial surfaces [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 267, 1970.

Artus, D. S. *See* Pickett, G. R. 00842

Atkins, Edward G. *See* West, Robert M. 00942

Atkinson, Lee C. *See* Fowler, Michael L. 00702

00594 **Babcock, Randall Scott.** Metasomatism, metamorphic segregation and fusion in the migmatitic Skagit Gneiss complex, Washington State [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 324-325, 1970.

Bailey, Leslie F. *See* Allen, Joe H. 00812

08232 **Baillie, A. D.; Vecsey, G. E.** Diagenesis and porosity in carbonate rocks [abs.], *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 526, 1969.

00668 **Bain, Roger J.** Weathering pattern in the Cambrian Catoctin Greenstone, Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 192, 1970.

00516 **Balkwill, Hugh Robert.** Structural analysis of the Western Ranges, Rocky Mountains, near Golden, British Columbia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3236B, 1970.

00947 **Ball, M. M.; Harrison, C. G. A.** Crustal plates in the Central Atlantic: Science, v. 167, no. 3921, p. 1128-1129, illus., 1970.

Various people have proposed that North and South America are a part of a gigantic crustal plate within which little differential movement is taking place. Considerations of the size of this postulated plate and the pattern of seismicity around the Caribbean indicate that it is in fact two plates, separated in the region between the Lesser Antilles and the Mid-Atlantic Ridge. Many of the offsets of the Mid-Atlantic Ridge opposite the Caribbean are the result of differential spreading rates and the westward continuations of the fracture zones extending from these offsets are active left-lateral faults. — Authors' abstract

00843 **Baltosser, R. W.; Lawrence, H. W.** Application of well logging techniques in metallic mineral mining: Geophysics, v. 35, no. 1, p. 143-152, illus., tables, 1970.

Nearly all well logging devices currently used in the petroleum industry have found some application in metallic mineral exploration and mining, but the emphasis in the mineral industries has been on those devices regarded as "exotic" or "specialty" by the petroleum industry. Mining problems which are solvable with well-logging methods include bulk assay and recognition of minerals adjacent to and retired from a borehole, delineation of joint and fracture systems, leaching problems, bank stability in open pit mines, roof and pillar loading in shaft mines, grindability, and drilling penetration rates. Devices useful for these problems include those which measure electrical properties, natural and induced nuclear radiation, seismic velocities, temperature, mechanical features of a borehole, and borehole photography. — *from* Authors' abstract

Bambach, Richard K. *See* Levinton, Jeffrey S. 00961

Bankston, Donald C. *See* Thompson, Geoffrey. 00853

00830 **Barash, M. S.; Kharin, G. S.; Yemel'yanov, Ye. M.** Asfal'tovoye ozero na ostrove Trinidad [Asphalt lake on the island of Trinidad]: Priroda 1970, no. 2, p. 65-69, illus., 1970.

This popular account of a visit of members of the Russian research ship, "Dmitriy Mendeleyev", to Pitch Lake in Trinidad cites historical references to the lake, describes its geology and the composition, reserves, and uses of the asphalt. A map of the lake area and a cross section of the lake are given. — EH

Barghoorn, Elso S. *See* Grew, Edward S. 00954

00669 **Barlow, James A.** Age and lithostratigraphic correlatives of the youngest Pennsylvanian strata in Tennessee [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 192-193, 1970.

08251 **Barnes, M. P.; Parry, W. T.** Porphyry copper deposits — A computer analysis of significance of geologic parameters [abs.]: Mining Eng., v. 21, no. 12, p. 55, 1969.

00557 **Barringer, A. R.; McNeill, J. D.** Recent developments in remote sensing for geophysical applications: Canadian Petroleum, v. 11, no. 2, p. 35-40, illus., 1970.

The article outlines functions of improved versions of Input (Induced Pulse Transient) and Radiophase systems and their applications to geologic mapping. The Input system was modified from 6 to 12 channels and an FM data recording system was added. A study conducted at Winkler, Manitoba, indicated the ability of the system to locate gravels in various types of clay and loam. The data was verified by ground data of the Provincial Department of Highways. The advanced version of Radiophase measures inphase and quadrature-phase components of the VLF magnetic field, and is fully automated. Used in a field study in Quebec, preliminary results showed that Radiophase delineated conductive structures such as faults and shear zones and responded to massive sulfides. It responds to resistivity variations at the higher end of the resistivity scale whereas Input responds to and distinguishes between more moderate values of resistivity. — EH

00670 **Basan, Paul B.** Aspects of sedimentation and development of a carbonate bank in the Barracuda Keys, Florida [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 193, 1970.

00972 **Basson, Philip W.; Wood, Joseph M.** *Algites enteromorphoides* sp. nov., a filamentous alga of Devonian age from Missouri: Am. Midland Naturalist, v. 83, no. 1, p. 283-290, illus., 1970.

Algites enteromorphoides (new species) is described as a compression fossil of a filamentous marine alga. The specimens were found in the shale portion of the Holts Summit Formation (Upper Devonian) in Boone County, Missouri. Comparison with an extant genus of alga is made on the basis of external morphology. Reproductive structures remain unknown. — Authors' abstract

Batcha, J. P., Jr. *See* Denny, J. R. 08253

Baugher, J. W., 3d. *See* Harkins, Kenneth L. 08223

08208 **Baumgartel, Hans.** Alexander von Humboldt — Remarks on the meaning of hypothesis in his geological researches, *in* Toward a history of geology (C. J. Schneer, editor) — New Hampshire Inter-Disciplinary Conf. History of Geology, 1967, Proc.: Cambridge, Mass., and London, M.I.T. Press, p. 19-35, 1969.

In 1769, when von Humboldt was born, knowledge of geology was fragmentary, from observations of naturalists, miners, and mineralogists, and of cosmogonic and geogonic systems. When he died at the age of 90, he had helped shape the first golden age of geology; pursuing many fields of science at the same time, von Humboldt was perhaps the last true universal scholar in physical sciences. He was attracted by the controversial origin of basalt, and leaned toward neptunism but never with the finality of Werner, his teacher, whose mistakes in the geological system he later helped to correct. His hypothesis of a universal law for strike and dip of rock strata in all mountains led to his famous American trip which substantiated his idea in a parallelism he thought caused by major forces of gravity and rotation of the Earth. This idea developed into a contraction hypothesis, and to his universal identity of strata by composition and index fossils. — GDC

00671 **Bearce, Denny N.** Stratigraphy of a conglomerate in the Silurian Red Mountain Formation of Alabama [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 193-194, 1970.

Beard, M. E. *See* Bradley, W. H. 08306

Begemann, F. *See* Craig, H. 00845

00863 **Behrens, E. William.** Holocene high stands of relative sea level in the western Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 267-268, 1970.

00864 **Behrens, E. William.** Stable carbon isotope in Gulf of Mexico cores [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 268, 1970.

08335 **Belt, Edward S.** Newfoundland Carboniferous stratigraphy and its relation to the Maritimes and Ireland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 734-753, illus., tables, 1969.

Early Mississippian through Pennsylvanian strata are in a narrow zone that trends from southwestern Newfoundland northeast to White Bay on eastern Great Northern Peninsula; strata outside this zone occur in thin patches only. Sedimentary facies within the zone indicate that the southeastern margin was a major high-angle fault active during Carboniferous. Post-Acadian strata of Nova Scotia and New Brunswick include Late Devonian rocks, conformable beneath Lower Mississippian, which form part of the rift sequence. Evidence is given which suggests that the Newfoundland diastrophic events are related closely to those in the Maritimes, and suggest a Late Devonian development of a rift valley. Comparisons with northern Ireland show striking similarities, considered by Belt to be entirely consistent with the theory of continental drift. — VSN

08233 **Belyea, H.** Features of the carbonate front, Sulphur Point Formation, District of [Mackenzie, northern Alberta and northeastern British] Columbia [abs.], *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 527, 1969.

00672 **Benham, Steven R.; Boyce, Robert L.; Drexler, Wallace W.; Hamilton, Michael M; Smith, Lester B., Jr.** A carbonate sand beach, Bahia Honda Key, Florida [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 194, 1970.

08259 **Bennett, Richmond.** Exploration for hydrothermal mineralization with airborne geochemistry [abs.]: Mining Eng., v. 21, no. 12, p. 64, 1969.

00673 **Bentley, Robert D.; Neathery, Thornton L.** Brevard fault zone of Alabama [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 194-195, 1970.

Bentley, Robert D. *See* Neathery, Thornton L. 00742

08268 **Ben-Yaakov, S.; Kaplan, I. R.** Determination of carbonate saturation of seawater with a carbonate saturometer: Limnology and Oceanography, v. 14, no. 6, p. 876-882, illus., tables, 1969.

A mathematical model has been established for the implementation of the Weyl saturometer, to obtain quantitative data on the degree of saturation (IP:*K*'sp) of calcite and aragonite to within ± 2 percent when the chlorinity and *p*H of the measured seawater are known. The method also enables carbonate alkalinity to be estimated to within ± 10 percent of values obtained by titration. Nomograms are given for the determination of degree saturation and total CO_2 for seawater of known *p*H, where a change in potential has been measured after exposing a calibrated glass electrode to a slurry of calcium carbonate in the original seawater. — Authors' abstract

00674 **Berdan, Jean M.** Ostracodes from the Lexington Limestone in Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 195, 1970.

Berg, Joseph W., Jr. *See* Thiruvathukal, John V. 00558

Berger, Rainer. *See* Bucha, V. 00952

Bergström, Stig M. *See* Sweet, Walter C. 00764

00549 **Berry, William B. N.; Takagi, Robert S.** Electron microscope investigation of *Orthograptus quadrimucronatus* from the Maquoketa Formation (Late Ordovician) in Iowa: Jour. Paleontology, v. 44, no. 1, p. 117-124, illus., 1970.

This study indicates that the microstructure of the cortical layer of the metasicula and thecal walls is composed of two alternating types of sublayers. One is a meshwork and the other resembles woven cloth, with two sets of fibers normal to one another. The fusellar layer of the periderm in the thecal and metasicula walls is formed of meshwork similar to the meshwork sublayer in the cortical layer. A sequence of deposition of various layers of the rhabdosome is suggested. — JWH

Berryhill, Henry L., Jr. *See* Garrison, Louis E. 00898

00675 **Best, David M.; Geddes, Wilburt H.; Hu, Tse-Chuang; Watkins, Joel S.; Walz, David H.** Gravity investigation of the contact between the Carolina slate belt and Charlotte belt of central North Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 195-196, 1970.

00595 **Beus, Stanley.** Stratigraphy of the Martin Formation in northwestern Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 325, 1970.

08249 **Beveridge, Thomas R.; Lacy, Willard C.; Mellckian, Gary E.; Neilson, James M.** Geological engineering — A profession ready to stand up and be recognized [summ.]: Mining Eng., v. 21, no. 9, p. 46, 56-57, 1969.

Geological engineering is a disputed discipline, with an insecure professional standing. In discussing its scope, a definition worked out some years ago is used. Implications contained in it are that geological engineers operate in: mineral exploration and production; construction and civil engineering; and other related fields, hydrogeology, coastal engineering, etc. Geological engineers should be registered as such; registration as any other type of engineer discounts their unique background and the special applications where dual training is needed. In a geological engineering curriculum, a balance of basic courses should be achieved and integrated with engineering courses directed toward applied geology; the curriculum core would be geology, and engineering drawing, surveying, and introductory geologic mapping as necessary parts. — ESL

08286 **Bilelo, Maria A. M.** The fossil shark genus *Squalicorax* in north-central Texas: Texas Jour. Sci., v. 20, no. 4, p. 339-348, illus., table, 1969.

Study of vertebrate teeth recovered from Pawpaw, Woodbine, Eagle Ford, Austin, Taylor, Navarro formations, and the Littig Member of the Kincaid Formation reveals the presence of *Squalicorax pristodontus* (Agassiz), *S. falcatus* (Agassiz) and *S. kaupi* (Agassiz) in 17 localities. The stratigraphic ranges of these species indicate that zonations are more distinct in Texas than in Europe and Africa, where the ranges apparently overlap to a great extent. Posterior teeth of *S. kaupi* and *S. falcatus* may be confused unless a representative collection of adult teeth of each species is available. Measurement of the apex angle may also be helpful in the determination of species. Both the mean and mode values of this angle show distinct divisions between each species. — Author's abstract

00865 **Billings, Gale K.** Some chemical characteristics of the Mississippi River plume [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 268, 1970.

Bingham, Roy H. *See* Moore, Gerald K. 08356

00981 **Bischoff, James L.; Greer, Randall E.; Luistro, Antonio O.** Composition of interstitial waters of marine sediments — Temperature of squeezing effect: Science, v. 167, no. 3922, p. 1245-1246, illus., table, 1970.

Warming of samples of marine sediments to room temperatures prior to the extraction of interstitial water accounts for the apparent enrichments of potassium (13.3 percent) and chloride ion (1.4 percent) and depletions of magnesium ion (2.5 per-

cent) and calcium ion (4.9 percent). These differences are the result of changes in ion-exchange selectivity as a function of temperature. — Authors' abstract

08254 **Bishko, Donald; Dunn, James R.; Wallace, William A.** Mineral resource planning and simulation [abs.]: Mining Eng., v. 21, no. 12, p. 62, 1969.

00820 **Black, David C.** Trapped helium-neon isotopic correlations in gas-rich meteorites and carbonaceous chondrites: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 132-140, illus., tables, 1970.

Stepwise heating experiments have been carried out on the dark portions of the gas-rich meteorites Kapoeta, Fayetteville, Pantar, Nogoya, Pultusk, Holman Island and the C2 carbonaceous chondrite Nogoya light, to determine more precisely the march of trapped helium, neon, and argon. Isotopic variations of up to a factor of 7 exist in trapped helium and correlate with variations in trapped neon. A plot of trapped He-3/Ne-4 and Ne-20/Ne-22 ratios shows that gas-rich meteorites define a zone, called the GRZ. Nogoya and several analyses of Mokoia define a "carbonaceous chondrite corridor" which is distinct from the GRZ. Trapped helium and neon in meteorites is found to result from a multicomponent mixture. The primary components may be related by a nuclear process; mass fractionation has played a minor role in altering the trapped helium-neon compositions. — *from* Author's abstract

00676 **Black, Douglas F. B.** Structural features in part of central Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 196, 1970.

Blackburn, W. H. *See* Hunt, Graham. 00788

00677 **Blackburn, William H.** Dendritic crystallization in silicate systems [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 196-197, 1970.

Blackburn, William H. *See* Moore, Bruce R. 00741

00678 **Blancher, Donald W.; Brown, William R.** Origin of the Hazel Patch Sandstone Member of the Lee Formation (Pennsylvanian) of eastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 197, 1970.

00866 **Blank, Horace R.** Incised meanders in Mason County, Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 269, 1970.

Blankenship, Terry L. *See* Neff, James R. 00743

00517 **Blecha, Matthew.** The origin of the Breton Breccia, Batchawana area, Ontario [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3237B, 1970.

00596 **Bluemle, John P.** Anomalous hills and associated depressions in central North Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 325-326, 1970.

00867 **Boenig, Charles M.** Temporal and spatial relationships of lower Eocene deltaic and coastal interdeltaic environments, east central Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 269, 1970.

Boettcher, A. L. *See* Hill, Robin E. T. 00809

00868 **Bombolakis, Emanuel G.; Rizer, William D.; Rainville, George D.** Study of closed crack behavior during preliminary stages of brittle fracture in uniaxial compression [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 269-270, 1970.

Bond, Thomas A. *See* Scrudato, Ronald J. 00761

Bonham-Carter, Graeme. *See* Harbaugh, John W. 08199

Bonnett, Richard B. *See* Neff, James R. 00743

Bonta, Bruce D. *See* Pestana, Harold R. 00564

00789 **Bornhold, Brian D.** Carbonate turbidites in Columbus Basin, Bahamas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 197-198, 1970.

08384 **Boss, Kenneth J.** Lucinacea and their heterodont affinities (Bivalvia): Nautilus, v. 82, no. 4, p. 128-131, 1969.

McAlester has recently (1966) hypothesized that the Lucinacea be elevated to the highest categorical rank short of class level, based on the probable phylogenetic relationship between the Ordovician *Babinka* and modern lucinaceans and his belief that it is related to the Monoplacophora. The lucinoids did appear sometime in the early Paleozoic. Allen (1958) describes the adaptive features of numerous lucinoids and the conservative features which allow phylogenetic relationships of this superfamily to be recognized. Heterodont features constitute noteworthy traits. When Dall (1895) established the Teleodesmacea, an order tantamount to heterodonts, it included the Lucinacea. Zoological evidence refuting their elevation to the rank of subclass, separating them from other bivalves, particularly Heterodonta, is given. They are endowed with basic heterodont characteristics, and obviously belong to the Heterodonta. — ESL

Bottinga, Y. *See* Weill, D. F. 00964

Bottino, Michael L. *See* Fullagar, Paul D. 00703

Boucher, Gary. *See* Ryall, Alan. 00944

Boucot, A. J. *See* Gauri, K. L. 00550

08325 **Boucot, A. J.** Silurian-Devonian of northern Appalachians — Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 477-483, illus., 1969.

Lithofacies and paleogeographic data from Silurian and Early Devonian rocks of Newfoundland are incomplete. As a result, the relations of these rocks to equivalent strata in the Appalachians and British Isles cannot be established. The scarcity of post-Llandoverian Silurian fossils and of Silurian graptolites is particularly anomalous. — Author's abstract

08388 **Boudreaux, Joseph E.; Hay, William W.** Calcareous nannoplankton and biostratigraphy of the late Pliocene-Pleistocene-Recent sediments in the Submarex cores [with Spanish abs.]: Rev. Española Micropaleontología, v. 1, no. 3, p. 249-292, illus., 1969.

The cored section of late Cenozoic sediments, penetrating to 5,634 cm below the sea floor on the Nicaragua Rise south of Jamaica, is subdivided into five biostratigraphic zones on the basis of coccolithophore assemblages. The four upper zones remain as defined by Boudreaux and Hay (in Hay et al., 1967), but the lowermost is here redefined as the *Sphenolithus abies* Zone, to replace the *Discoaster extensus* Zone. The Pliocene-Pleistocene boundary is placed at the extinction level of *Discoaster brouweri*, with a probable age of 1.8 m.y. Under the class Coccolithophyceae, a new suborder, a new family, three new subfamilies, and three new tribes are diagnosed; 34 species in 24 genera are described, including three new genera and species, *Crassapontosphaera jonesi*, *Koczyia lepida*, *Ellipsodiscoaster lidzi*, and two new species of *Scyphosphaera*. — VMJ

Bower, C. A. *See* Muhammed, Shah. 08397

Boyce, Robert L. *See* Benham, Steven R. 00672

08260 **Boyer, Paul S.** Pelecypod beak wear — An indicator of postmortem transportation: Texas Jour. Sci., v. 20, no. 4, p. 385-387, illus., 1969.

Valves spring open when the animal dies, and any movement of the shell will then produce wear on the opposed beaks until the shell comes to rest or the ligament gives way and the valves separate. Beak abrasion facets have been observed on several

Gulf Coast species. When an intermediate facet is present, it is good evidence that the clam died in turbulent waters, and could be a paleoenvironment indicator. — ESL

00869 **Boyer, Robert E.** Environmental pattern recognition from Apollo photography of the Dallas-Fort Worth area [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 270, 1970.

00870 **Brace, William F.; Ernst, W. Gary; Kallberg, Razel Wittels.** An experimental study of tectonic overpressure in Franciscan rocks [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 271, 1970.

08252 **Bradbury, J. C.; Ehrlinger, H. P.** Industrial minerals research at the Illinois State Geological Survey [abs.]: Mining Eng., v. 21, no. 12, p. 59, 1969.

Bradley, W. H. *See* Iovino, A. J. 08269

08306 **Bradley, W. H.; Beard, M. E.** Mud Lake, Florida; its algae and alkaline brown water: Limnology and Oceanography, v. 14, no. 6, p. 889-897, illus., table, 1969.

Algal ooze accumulations were studied at Mud Lake, Marion County, Fla., a small, very shallow lake in an old sinkhole. Such accumulations are considered modern analogs of ancient algal sediments that were precursors of oil shale such as that of the Eocene Green River Formation. The water contains about 200 ppm dissolved solids (Fe, Ca, PO_4, tannin-lignin, etc.), is brown to nearly colorless, and is always alkaline (pH 7.7 to 10.2). The sediment consists of minute fecal pellets produced mainly by chironomid larvae and composed solely of blue-green algae which show little seasonal variation. Filamentous green algae are abundant in winter but are not preserved in the ooze. A bacterial inhibitor, known to be present but not yet isolated, is probably the chief cause of low bacterial counts in both water and top layer of sediment. — VMJ

00597 **Bradley, William C.; Fahnestock, Robert K.; Rowekamp, Edward T.** Size-sorting and shape-sorting along Knik River, Alaska [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 326, 1970.

08261 **Bradshaw, Peter M. K.; Clews, D. Richard; Walker, John L.** Exploration geochemistry — Pt. 1, Introduction: Mining in Canada [v. 42], Dec., p. 34-37, illus., 1969.

This article is the first of a series of seven to be published in Mining in Canada, dealing with the principles and uses of geochemistry in mineral exploration. The current article presents a review of general principles and succeeding articles will describe the essential features of the different phases of geochemical exploration in Canada and a look at the future of geochemical exploration. Also outlined are the distribution processes and patterns of metals associated with an orebody in rocks, soils, water, vegetation, stream sediments and air. — Authors' abstract

00795 **Brainerd, Arthur E.** Memorial to Carroll Edward Dobbin (1892-1967): Geol. Soc. America Proc. 1967, p. 197-201, portrait, 1970.

Bridgwater, D. *See* Allaart, J. H. 08419

00536 **Brinkmann, Robert Terry.** The photodissociation of water vapor, evolution of oxygen and escape of hydrogen in the Earth's atmosphere [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3246B, 1970.

08395 **British Columbia Minister of Mines.** (and Petroleum Resources). Annual report for the year ended December 31, 1968: Victoria, B. C., British Columbia Dept. Mines and Petroleum Resources, 513 p., illus., tables, 1969.

In addition to a review of the mineral industry in British Columbia for 1968 and a summary of department work, this report contains: a general review of metal mining

and exploration and reports on metal mines; a tabulation of geological, geophysical, and geochemical reports credited for assessment in 1968; brief summaries of structural materials and industrial minerals mines and deposits; a review of petroleum and natural gas developments; and report on coal mines. — MCM

Broecker, Wallace S. *See* Ku, Teh-Lung. 08214

00871 **Brookins, Douglas G.** Mechanism(s) of emplacement of Riley County, Kansas kimberlites [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 271, 1970.

00872 **Brookins, Douglas G.; Chaudhuri, Sambhudas.** Potassium-argon and rubidium-strontium geochronologic investigation of calcareous shales (Lower Permian) near Manhattan, Kansas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 272, 1970.

00873 **Brooks, Robert A.** Clay mineralogy and geochemistry of interstitial waters of recent sediments west of the Mississippi River delta [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 272, 1970.

00874 **Brown, Anton.** Measurement of recoverable strain in rocks from Llano, Texas, and Cody, Wyoming [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 273, 1970.

Brown, Jerry. *See* Anderson, Duwayne M. 00815

00598 **Brown, Randall E.** Some effects of irrigation in the Pasco Basin, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 326-327, 1970.

08337 **Brown, Richard L.; Helmstaedt, Herwart.** Paleozoic wrench faults in Canadian Appalachians — Discussion [of paper by G. W. Webb, 1969], *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 787, 1969.

Results from recent work by the above authors in Charlotte County, southern New Brunswick, are incompatible with Webb's hypothesis (ibid., p. 754-786, 1969) of strike-slip movements. The faulting history appears to involve near dip-slip movements; the southeastern extension of the Belleisle fault and adjacent NE-trending faults have a history of high-angle oblique-slip to dip-slip movements from at least pre-Late Devonian time. — VSN

Brown, William R. *See* Blancher, Donald W. 00678

00679 **Brown, William R.; Griswold, Thomas B.** Superposed folding in the Arvonia Slate district, Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 198, 1970.

08352 **Bruckner, W. D.** Geology of eastern part of Avalon Peninsula, Newfoundland — A summary, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 130-138, illus., 1969.

This paper concerns the stratigraphy and structure of the area east and southeast of Conception Bay and three islands in the eastern part of the bay, but reference is made also to Bay de Verde Peninsula west of Conception Bay. Two N-S striking fault zones, east and west of the bay, divide the region into Eastern, Middle, and Western blocks of Precambrian to Early Ordovician rocks. Information is summarized from published papers, particularly those of Hutchinson, 1953; McCartney, 1954, 1967; and Rose, 1952. — VSN

Brune, James N. *See* Anderson, Don L. 00811

08265 **Brunskill, Gregg J.; Ludlam, Stuart D.** Fayetteville Green Lake, New York — [Pt.] 1, Physical and chemical limnology: Limnology and Oceanography, v. 14, no. 6, p. 817-829, illus., tables, 1969.

A new bathymetric map has been made for Fayetteville Green Lake, a meromictic lake with surface and subsurface inflow and surface outflow. From morphometric parameters and an approximation of density differential between mixolimnion and monimolimnion, a meromictic stability of 1,700 g-cm cm^{-2} is estimated. Possible biogenic vs. crenogenic (different ground-water sources) origins of the meromixis are discussed, considering ground-water composition, temperatures, and heat distribution by the wind. Ionic compositions of the water column of the lake and of ground water from wells in the area suggest that the subsurface inflow comes from the ground water of the Vernon and Camillus shales. Theoretical replenishment time of the total water mass is estimated as 2 to 3 years, or 1.0 to 1.7 years for the mixolimnion alone. — VMJ

08266 **Brunskill, Gregg J.** Fayetteville Green Lake, New York — [Pt.] 2, Precipitation and sedimentation of calcite in a meromictic lake with laminated sediments: Limnology and Oceanography, v. 14, no. 6, p. 830-847, illus., tables, 1969.

Activities of calcium and carbonate in the lake were estimated from detailed seasonal measurements of pH, calcium, and titration alkalinity. The water column was found to be supersaturated with calcite throughout the year. Maximal crystal loads of 35 g $CaCO_3$ m^{-2} in the water column occurred in June and July (1965-67); loads in fall, winter, and early spring were reduced by an order of magnitude; settling rates of 2-4 m day^{-1} were estimated for spring. About 90 percent of the total sedimentation occurred from June through October, and 80 percent of this mass was calcite. Laminae in the monimolimnetic sediments are regarded as annual couplets resulting from seasonal sedimentation of calcite and deposition of dark-colored organic and clastic matter throughout the year. From the chemical composition of sediment trap samples, annual sedimentation rates were derived for the calcite and other components. — VMJ

08267 **Brunskill, Gregg J.; Harriss, Robert C.** Fayetteville Green Lake, New York — [Pt.] 4, Interstitial water chemistry of the sediments: Limnology and Oceanography, v. 14, no. 6, p. 858-861, illus., tables, 1969.

Studies on interstitial waters from monimolimnetic sediments of Fayetteville Green Lake have demonstrated the presence of water of increasing salinity with depth, chemically different from overlying water of the monimolimnion. Interstitial water from sediments above the plane of the chemocline does not differ greatly from overlying water of the mixolimnion. — Authors' abstract

08226 **Bryant, A. C.; Koch, N. G.** Diagenetically controlled sedimentary features in Lower Paleozoic core in Canada's Arctic Archipelago, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 376-391, illus., table, 1969.

Of the three wells drilled in Canada's Arctic Islands, one at Winter Harbour in the Parry Islands encountered 2,000 feet of the (?) Ibbett Bay Formation. Core from interval 9790 to 9811 feet comprises finely laminated calcareous shales and limestones, a little silicified. Nodular forms of micritic limestone, with an occasional rind of silica, show horizontal bedding extending into adjacent shales, where abrupt thinning indicates compaction. Above and below each nodule, the compacted shales bend around it. In other parts of the core compaction is due to lateral variation in percentage of $CaCO_3$; the more calcitic nodules were cemented early enough to resist compaction. Sutured stylolites, most of them vertically oriented in thin laminations in argillaceous limestone, suggest post-compaction and lithification associated with the tectonic folding. — GDC

00952 **Bucha, V.; Taylor, R. E.; Berger, Rainer; Haury, E. W.** Geomagnetic intensity — Changes during the past 3000 years in the Western Hemisphere: Science, v. 168, no. 3927, p. 111-114, illus., table, 1970.

A series of archeomagnetic measurements have been carried out on archeologic materials from Arizona and Mexico which can be compared with results from Europe and Asia. This comparison shows a westward drift of geomagnetic intensity at a rate of about 0.24 degree per year. Furthermore, an apparent coincidence between

changes in the Earth's magnetic moment and changes in the production rate of radiocarbon is observed. — Author's abstract

08282 **Buerger, Martin J.** Equi-inclination rotating-crystal photographs [with German abs.]: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 173-184, illus., table, 1969.

The ordinary rotating crystal photograph taken by the normal-beam technique has a large central blind region. The equi-inclination technique can explore almost the entire volume of a sphere whose radius is two reciprocal-lattice units, and without a blind region. A special equi-inclination rotating crystal instrument is described. Fibers, twinned crystals, and similar aggregates produce equi-inclination photographs which have three advantages over the normal-beam: there is no central blind region; exactly twice as many layer lines are recorded; at a given level ζ, the range of recorded ξ is greater. Photographs can be indexed with the aid of a chart, corresponding to the Bernal chart for normal-beam. — *from* Author's abstract

00556 **Bukry, David.** *Biscutum kennedyi* nom. nov. pro *Biscutum asymmetricum* Bukry, 1969, non Perch-Nielsen, 1968 (Plantae, Coccolithophyceae): Jour. Paleontology, v. 44, no. 1, p. 167, 1970.

The Cretaceous [Austin Chalk, Texas] coccolith name *Biscutum asymmetricum* Bukry, 1969, is a later homonym of *B. asymmetricum* Perch-Nielsen, 1968, and is replaced by the new name *Biscutum kennedyi Bukry*.

00875 **Bullard, Fred M.; Rylander, Don L.** Holocene volcanism in Craters of the Moon National Monument and adjacent areas, south-central Idaho [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 273-274, 1970.

Bunker, Carl M. *See* Neuschel, Sherman K. 00973

Burchett, Charles R. *See* Moore, Gerald K. 08356

00876 **Burchfiel, B. C.; Davis, Gregory A.** Basement involvement in southeastern Cordilleran thrust faulting — A regional synthesis [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 274, 1970.

00877 **Burchfiel, B. C.; Davis, Gregory A.** A zwischengebirge in the Cordilleran orogen and its tectonic significance [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 274-275, 1970.

Burlingame, A. L. *See* Simoneit, B. R. 00943

00680 **Butler, J. Robert.** Brevard zone and adjacent rocks east of Ashville, North Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 198-199, 1970.

00823 **Buturla, Frank, Jr.** Geology and ground water resources of Wells County — Pt. 3, Ground water resources: North Dakota Geol. Survey Bull. 51, pt. 3 (North Dakota Water Comm. County Ground Water Study 12), 57 p., illus., table, 1970.

Water is obtained from aquifers in the glacial drift and underlying Cretaceous rocks, the first having the greatest potential for large withdrawals. Drift aquifers consist of sand and gravel deposits underlying surficial outwash plains and channels, and in buried valleys. Nine major drift aquifers were mapped and described. Yields in excess of 500 gpm are possible from the New Rockford aquifer, a buried valley, and as much as 500 gpm from the Manfred and Heimdal. Little is known concerning water-bearing properties of the Cretaceous rocks, but it is not expected that yields comparable to those from the drift aquifers could be obtained. Water from drift aquifers is generally very hard, but only moderately saline; that from the Cretaceous is soft, but rather saline, unsuitable for irrigation. — *from* Author's abstract

00878 **Byerlee, James D.** Sliding characteristics of finely ground surfaces of gabbro and dunite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 275, 1970.

00879 **Cadot, H. Meade, Jr.** Statistical analysis of intraspecific variation in carapace morphology of selected Recent Ostracoda from Bermuda [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 275-276, 1970.

00540 **Calder, John Archer.** Carbon isotope effects in biochemical and geochemical systems [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. p. 3265B, 1970.

Calvin, Melvin. *See* Han, Jerry. 08377

08284 **Calvo, C.; Leung, K. Y.** Refinement of the structure of stranskiite: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 231-233, tables, 1969.

A number of structures containing tetrahedral AsO_2^- have been reported recently. Since data by Plieth and Sanger (1967) for stranskiite varied from others, they were refined further using a full-matrix least-squares program. The value of *R* dropped from 0.11, as reported, to 0.063. Values of the new atomic parameters are compared to previous values, and new bond distances and angles are tabulated. All tetrahedral bond angles lie within 2.6° of the ideal value. — ESL

00681 **Cameron, Cornelia C.** Geologic factors related to peat resources near the Allegheny Front south of the glacial border [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 199, 1970.

Camp, Mark J. *See* Hatfield, Craig B. 00567

00662 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheet 53, Ontario-Manitoba: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00663 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheets 62 and 64, Manitoba-Saskatchewan: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00664 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheet 73, Saskatchewan-Alberta: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00665 **Canada Geological Survey.** Geologic maps published by the Geological Survey of Canada — Index Sheet 87,97, District of Franklin-District of Mackenzie: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

08429 **Canada Geological Survey.** Aeromagnetic series, Twillingate, Newfoundland: Canada Geol. Survey Geophysics Paper 4452, scale 1:63,360, 1969.

08430 **Canada Geological Survey.** Aeromagnetic series, Fogo, Newfoundland: Canada Geol. Survey Geophysics Paper 4453, scale 1:63,360, 1969.

08431 **Canada Geological Survey.** Aeromagnetic series, Wadham Islands, Newfoundland: Canada Geol. Survey Geophysics Paper 4454, scale 1:63,360, 1969.

00682 **Carpenter, Robert Heron; Fagan, James.** Stream sediment geochemistry — A valuable tool for locating zinc mineralization in the Knox Dolomite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 199-200, 1970.

00753 **Carpenter, Robert Heron.** Metamorphic history of the Blue Ridge province of Tennessee and North Carolina: Geol. Soc. America Bull., v. 81, no. 3, p. 749-761, illus., 1970.

A study of metamorphic index minerals in 354 panned alluvial samples has led to delineation of metamorphic isograds in the Blue Ridge province of Tennessee and North Carolina. Well-defined kyanite and sillimanite zones are flanked by lower grade zones. Radiometric age determinations indicate the event took place 320 to

375 m.y. ago. In NE Tennessee and NW North Carolina it was superimposed on higher grade rocks metamorphosed during the Grenville orogeny; in the southeastern Blue Ridge, it produced a prograde sequence in the Ocoee Series. Mid-Paleozoic plutons are confined mainly to the kyanite and sillimanite zones. Granites are interpreted as formed by anatexis, pegmatites by magmatic or metamorphic differentiation, or by anatexis. Ultramafics probably were implaced early in the regional metamorphism. Most of the movement of the Blue Ridge thrust sheet probably followed the mid-Paleozoic metamorphism. — *from* Author's abstract

00683 **Carver, Robert E.** Late Pleistocene and Holocene sediments sources, continental shelf of Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 200, 1970.

Case, D. R. *See* Laul, J. C. 00955

00537 **Caswell, William Bradford, Jr.** The hydrogeology of thin-limestone layers in east-central Ohio [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3260B-3261B, 1970.

00599 **Cattermole, J. M.; McGregor, E. E.** Tertiary and Quaternary gravels in the Rapid City area [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 327, 1970.

00518 **Cecil, Charles Blaine.** Silica in experimental diagenesis of sandstones [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3237B-3238B, 1970.

00880 **Chapple, William M.** The initiation and spacing of folds in viscous multilayered media [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 276, 1970.

Chaudhuri, Sambhudas. *See* Brookins, Douglas G. 00872

Cheng, C. N. *See* Stevenson, F. J. 00818

08206 **Chow, Tsaihwa J.; Snyder, Carrie B.** Indium content of sea water: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 221-223, illus., tables, 1969.

The indium content of sea water was determined by mass spectrometry. An indium profile in the Pacific Ocean to a depth of 3571 m showed an average concentration of 0.004 μg per liter of sea water. — Authors' abstract

00565 **Christensen, Nikolas I.** Possible greenschist facies metamorphism of the oceanic crust: Geol. Soc. America Bull., v. 81, no. 3, p. 905-907, illus., tables, 1970.

Compressional wave velocities are reported to pressures of 6 kb for 15 cores of greenstone. The experimental velocities for greenstone are shown to be similar to velocities obtained from seismic refraction measurements of layer 3 of the oceanic crust, thus suggesting that greenschist facies metamorphism may be important in lower oceanic crustal rocks. — Author's abstract

Christodoulides, C. *See* Durrani, S. A. 00585

08234 **Chunta, A.** The Halfway Reservoir western portion, Peejay Field, British Columbia [abs.], *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 528, 1969.

08350 **Church, W. R.** Metamorphic rocks of Burlington Peninsula and adjoining areas of Newfoundland, and their bearing on continental drift in North Atlantic, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 212-233, illus., tables, 1969.

The high-grade metamorphic rocks, known as the "Fleur de Lys Supergroup," in western Burlington Peninsula, are relevant to discussion of continental drift in the North Atlantic because of their similarity to the Moine-Dalradian metamorphic

rocks of Scotland and Ireland; this is particularly true of their orthotectonic nature and marginal position within the Appalachian and Caledonian Systems. Moine-Dalradian metamorphism is commonly considered as pre- or Early Ordovician, and if a similar age can be demonstrated for the Fleur de Lys metamorphism, their relation would be further emphasized. The intensity of metamorphism evident in the Fleur de Lys is more in accord with an Early Ordovician age (post-Llanvirnian-pre-Caradocian) than with the mild effects of the Taconian orogeny evident in other areas of the Appalachians. — VSN

00519 **Clark, George Richmond, 2d.** Shell characteristics of the Family Pectinidae as environmental indicators [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3238B, 1970.

00881 **Clark, H. C.; Hickcox, Alice E.** Remanent magnetic stability and cooling history of the Mary's Peak sill, Oregon [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 276-277, 1970.

00600 **Clayton, Lee; Hagmaier, J. Ladd.** Tertiary lakes in the Williston basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 327-328, 1970.

00684 **Cleary, W. J.** Petrology of Coastal Plain and Piedmont river sands, southeastern United States [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 200-201, 1970.

Cleaves, Arthur B. *See* Kiersch, George A. 08296

Cleaves, Arthur B. *See* Gaskins, John W. 08298

08302 **Cleaves, Arthur B.** Flagg's Restaurant area landslide, Pacific Palisades, California, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 75-79, illus., 1969.

The Pacific Palisades (Flagg's Restaurant area) landslide of 1958 was only one of several local ones that occurred in that year. However, the area in general has a landslide record extending back over many years. The toes of this slide spread across U.S. Route, Alternate 101, also known as the Coast Highway. There are three general methods of correcting and/or controlling landslides: (1) avoidance; (2) the application of *active* measures where the driving force of the slide is opposed by a resistive force (cribbing, buttresses, retaining walls, and so on); and (3) application of *passive* measures such as drainage, unloading by excavation, total, or near the crown, and benching. The treatment applied in this case, primarily because of possible legal conditions, was avoidance by relocation. — Author's abstract

Clevenger, W. A. *See* Waggoner, E. B. 08300

Clews, D. Richard. *See* Bradshaw, Peter M. K. 08261

00882 **Clifford, Paul M.; Rector, Roger J.** Fabric and compositional effects on strain in rocks [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 277, 1970.

08330 **Clifford, Paul M.** Evolution of Precambrian massif of western Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 647-654, illus., 1969.

Lithology, metamorphism, and internal structure of the Precambrian rocks of western Newfoundland clearly link them with rocks of nearby Labrador. Block motions, both vertical and horizontal, are implied by variations in the nature and position of the sedimentary cover. Lateral motion counterclockwise through 30° is indicated by paleomagnetic data. The movements can be ordered in time, and suggest that the formation of the western Newfoundland klippe (or klippen) was linked to the rotation of the Precambrian block. — Author's abstract

00858 **Cloud, W. K.; Hill, D. M.; Huffman, M. E.; Jennings, C. W.; McEvilly, T. V.; Nason, R. D.; Steinbrugge, K. V.; Tocher, D.; Unger, J. D.; Youd, T. L.** The Santa Rosa earthquakes of October, 1969: California Div. Mines and Geology Mineral Inf. Service, v. 23, no. 3, p. 43-63, illus., tables, 1970.

On October 1, 1969, the city of Santa Rosa was shaken by 2 earthquakes of 5.6 and 5.7 magnitudes, the most severe since 1906 when the city experienced catastrophic destruction. Epicenters of these shocks, an interval shock and 2 aftershocks were grouped in an area 2 miles north of the city; focal depths of the main shocks were 9.6 and 10.4 km. A buried fault is believed to be present beneath the unconsolidated alluvial fill which underlies the city. No lives were lost but 99 structures scattered throughout the city, chiefly older buildings, were seriously damaged. This report includes contributions on the geologic framework, earthquake history for the period 1855-1967, seismograph station and motion records, descriptions of epicenters, magnitudes, fault plane solutions and aftershocks, and seismic effects and damage. — EH

08358 **Colmet-Daage, F.; Delaune, M.; Robbart, F.; Lohier, G.; Younce, J.; Gautheyrou, J.; Gautheyrou, M.; Fusil, G.; Koukoui,** M. Caractéristiques et nature de la fraction argileuse de quelques sols rouges d'Haïti situés sur calcaires durs [with English and German abs.]: [France] Office Recherche Sci. et Tech. Outre-Mer Cahiers, Sér. Pédologie, v. 7, no. 3, p. 345-415, illus., tables, 1969.

Red soils on hard calcareous material show varied physical, chemical, and mineralogic characteristics, in spite of a similar appearance. A brief study of red soils derived from volcanics, and calcareous black soils, permits further comparisons. Clay minerals of calcareous red soils may be either montmorillonite or a 14A mineral which does not swell under glycol treatment, nor collapse on heating up to 600°C, or kaolinite, or, most frequently, a mixture of these, with variable amounts of gibbsite or boehmite. Transition from one type to another may be observed, and intermediate soils are frequently found. It is also possible to note changes in type of clay minerals from lower to upper parts of the profile. Limited effects of treatments to determine the 14A mineral emphasize its resistance to chemical agents. Original materials of these soils are discussed; most often it is montmorillonite clay. — *from* Authors' English abstract

Colquhoun, D. J. *See* Pierce, J. W. 00749

00500 **Coney, Peter J.** The geotectonic cycle and the new global tectonics: Geol. Soc. America Bull., v. 81, no. 3, p. 739-747, illus., table, 1970.

The concept of a geotectonic cycle has been interwoven in geosynclinal theory. The basic scheme is a progressive and somewhat deterministic sequence of events usually termed the geosynclinal phase, tectogenic phase, and orogenic phase. The geotectonic cycle, examined in light of geosynclinal history, studies in tectogenesis and advances in submarine geology and geophysics, is obsolete. There is considerable evidence that the entire cycle cannot be attributed to any single internal deterministic mechanism. The concept of multiple origins for mountain systems is suggested. Mountain complexes result from irregular successions of tectonic responses due to sea-floor spreading, shifting lithosphere plates, transform faults, and colliding, coupled, and uncoupled continental margins. — *from* Author's abstract

Conkin, Barbara M. *See* Conkin, James E. 08423

08423 **Conkin, James E.; Conkin, Barbara M.** *Paraspirifer acuminatus* from the *Brevispirifer gregarius* Zone at the Falls of the Ohio: Kentucky Acad. Sci. Trans., v. 30, nos. 3-4, p. 72-77, illus., 1969.

During study of Middle Devonian bone bed stratigraphy of the Jefferson County, Kentucky-southern Indiana area, an index brachiopod *Paraspirifer acuminatus* was noted 0.1 feet above the base of the *Brevispirifer gregarius* Zone of the Jefferson Limestone at the Falls of the Ohio, Clark County, Indiana. Concerned with the singular occurrence, this paper presents some stratigraphic and ecological information regarding *P. acuminatus*. A measured section immediately west of the whirlpool is illus-

trated. The single specimen described is a fragment of the pedicle valve, but sufficient detail is preserved for its confident assignment to *P. acuminatus*. The low convex residual portion was more stable in currents than the "spoonlike" brachial valve which was liable to be carried away and fragmented by wave action. — GDC

00685 **Connor, J. J.; Cressman, E. R.** Carbonate geochemistry of the Lexington Limestone and associated clays, Ferry Formation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 201, 1970.

Connor, J. J. *See* Tidball, R. R. 00768

00686 **Conolly, John R.** A model for eugeosynclinal deposition [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 201-202, 1970.

Cook, Earl F. *See* Tieh, Thomas T. 00933

00687 **Cook, Robert B., Jr.** Gold mineralization at the Latimer mine, Wilkes County, Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 202, 1970.

08255 **Coolbaugh, D. F.** La Caridad, Mexico's newest and largest copper ore deposit — An exploration case history [abs.]: Mining Eng., v. 21, no. 12, p. 63, 1969.

00848 **Coombs, D. S.; Horodyski, R. J.; Naylor, R. S.** Occurrence of prehnite-pumpellyite facies metamorphism in northern Maine: Am. Jour. Sci., v. 268, no. 2, p. 142-156, illus., 1970.

Prehnite-pumpellyite facies, pumpellyite-actinolite-schist facies, and transitional assemblages have been identified in Greenlaw and Mooseleuk Lake Quadrangles of northern Maine. This is the first report of the occurrence of these facies of low grade metamorphism in the Appalachian belt. Assemblages occur in a volcanic-rich sequence at least 3000 m thick of Ordovician through Devonian eugeosynclinal strata traceable southwestward into greenschist facies and high grade metamorphism. Chlorite-calcite and prehnite-pumpellyite-chlorite assemblages all plus albite ± sphene, sericite, and quartz may result from complementary metasomatic reactions under low grade burial metamorphic conditions. Mineralogic conformity between spilites, keratophyres, and sediments is evidence that the spilitic nature of the volcanics is the result of the same metamorphic processes as affected the sediments. — *from* Authors' abstract

00688 **Cooper, Byron N.** Southern Appalachian Middle Ordovician succession [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 202-203, 1970.

08424 **Cooper, G. Arthur; Grant, Richard E.** New Permian brachiopods from West Texas: Smithsonian Contr. Paleobiology, no. 1, [31] p., illus., 1969.

New taxa representing 13 superfamilies of articulate brachiopods are described from the Permian rocks of the Glass Mountains, Guadalupe Mountains, and other localities of trans-Pecos Texas; 35 new genera are diagnosed, 27 of them based on new species, which are briefly described; type species of all the genera are figured. The Chonetacea, Richthofeniacea, Productacea, and Rhynchonellacea are particularly well represented. *Cooperina* Termier, Termier and Pajaud, 1967, from the Glass Mountains, is shown to be unrelated to the Thecideidina, and more properly placed in the Strophalosiacea of Productina. This paper establishes about half of the new genera expected from the region; those that remain to be established are relatively rare or less important in stratigraphic relationships. — VMJ

Copeland, Charles W. *See* Drahovzal, James A. 00694

00541 **Coston, Wendell Ray.** Clay mineralogy and engineering properties of a shale-derived soil [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3308B, 1970.

00601 **Crabb, D. E.; Mowatt, T. C.** Preliminary mineralogic investigation of some clay horizons in the Fort Union and Ludlow Formations, North Dakota and South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 328, 1970.

08244 **Cracraft, Joel; Morony, John J., Jr.** A new Pliocene woodpecker, with comments on the fossil Picidae: Am. Mus. Novitates, no. 2400, 8 p., illus., 1969.

A new genus and species of woodpecker, *Palaeonerpes shorti*, is described from a left tibiotarsus from lower Pliocene sediments of Nebraska. *Palaeonerpes* is morphologically distinct from all genera with which it was compared, and no clear evidence is present to assign *Palaeonerpes* to any genus of Recent woodpecker. General comments on the systematic status of the known fossil picids are presented. *Palaeopicus* has several features which suggest that it probably should be excluded from the Picidae. *Uintornis* is not a woodpecker, as Shufeldt (1915) correctly surmised. *Pliopicus* is a morphologically distinct genus that does not appear related to any genus of North American woodpeckers. — Authors' summary

00845 **Craig, H.; Begemann, F.** Oxygen-18 variations in atmospheric carbon dioxide — The HASL data: Jour. Geophys. Research, v. 75, no. 9, p. 1723-1726, illus., 1970.

The HASL project data on oxygen-18 variations in atmospheric carbon dioxide are shown to be incorrect. The observed values and their variation with altitude are simply due to isotopic exchange with ground-level moisture included in the samples. The data do provide some indication that the humidity of the stratosphere may be nearly constant above 15 km. — Authors' abstract

00951 **Cramer, C. H.** Viscosity of the Atlantic Ocean bottom: Science, v. 167, no. 3921, p. 1123-1124, illus., 1970.

Two profiles across the Mid-Atlantic Ridge were analyzed to determine viscosity values. Viscous creeping of bottom features due to gravitational stress was assumed, as was sea-floor spreading at a rate of 2 centimeters per year. Values obtained agreed well with previous results obtained on the Fennoscandian Uplift, despite great differences in the horizontal dimensions of the bottom relief. — Author's abstract

Cressman, E. R. *See* Connor, J. J. 00685

00689 **Cressman, Earle R.** Facies and paleogeography of the Lexington Limestone of central Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 203, 1970.

Crimes, T. P. *See* Seilacher, A. 08314

00602 **Croft, Mack G.; Wesolowski, E. A.** Transmissivity and storage coefficient of aquifers in the Fox Hills Sandstone and Hell Creek Formation, Mercer and Oliver Counties, North Dakota [abs]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 328-329, 1970.

00960 **Crowell, John C.; Frakes, Lawrence A.** Phanerozoic glaciation and the causes of ice ages: Am. Jour. Sci., v. 268, no. 3, p. 193-224, illus., 1970.

Evidence is reviewed to show that a basic cause of glaciation is probably the arrangement of continental masses and their effect upon ocean circulation. Additional significant factors that interplay to bring about ice sheets are the elevation of continents, the elevation and extent of highlands, the availability of moisture sources, the freezing and thawing of polar seas, the effect of the snow and ice cover and frozen seas on the Earth's albedo and the mean Earth temperature, the positioning and swinging of storm tracks along the polar front with the development of strong airmass contrast, and others. When many of these factors reinforce, continental glaciation ensues. — *from* Authors' abstract

00603 **Csejtey, Béla, Jr.** Thrusting and overturning in the southeastern portion of the Flint Creek Range, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 329, 1970.

08425 **Culbertson, William C.** Oil shale in the Green River Formation, Green River Basin, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 191-195, illus., 1969.

This report summarizes the lithology, thickness, and distribution of the oil shale beds in this area. The shales are primarily in dolomite, or dolomitic limestone with varying amounts of kerogen, derived from aquatic plants and animals in the Eocene lake. The maximum thickness of the formation is 2,900 feet, and it is divided from bottom to top, into: Luman Tongue, and the Tipton Shale, Wilkins Peak, and Laney Shale Members. The oil shale is generally thickest and richest in the southeastern part of the Green River basin. — HRC

00690 **Curran, H. Allen.** Subsurface Cretaceous stratigraphy of the southeastern North Carolina coastal plain [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 203-204, 1970.

00883 **Curtis, Doris Malkin.** Miocene deltaic sedimentation, Louisiana Gulf Coast [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 277-278, 1970.

00884 **Dalziel, Ian W. D.** Mylonites and mylonitic belts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 278, 1970.

00691 **Daniel, Charles C.** Alteration of clays and associated minerals within the contact aureole of a diabase dike [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 204, 1970.

08414 **Dansgaard, W.** Oxygen-18 analysis of water, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 33-36, illus., 1969.

Samples of meltwater from the Greenland Icecap were analyzed for O-18 content, using a modified Nier-Consolidated mass spectrometer, model 21-201, provided with a double inlet system and a vibrating reed electrometer. — EH

00542 **Dastidar, Priyabrata Ghosh.** A study of trace elements in selected Appalachian sulphide deposits [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3308B-3309B, 1970.

Davidson, Franklin D. *See* Matter, Philip, 3d. 08378

00885 **Davies, David K.** Distribution and basinward transportation of Pleistocene sands and silts in the Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 278-279, 1970.

00886 **Davies, David K.; Ethridge, Frank G.** A recent model for marine bar deposition, and the recognition of bar environments through a study of sedimentary structures, textures and composition [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 279, 1970.

00692 **Davies, Tudor T.; Sayre, J. G.** The effect of environmental stress on pelecypod shell ultrastructure [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 204-205, 1970.

Davis, Gregory A. *See* Burchfiel, B. C. 00876

Davis, Gregory A. *See* Burchfiel, B. C. 00877

08235 **Davis, J. B.** Microbiology in petroleum exploration, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 139-157, illus., tables, 1969.

Microbial activities are related intimately to petroleum-exploration methods which involve a detection and assay of petroleum or natural gas in near-surface waters and sediments. The ability of microbes both to produce and consume hydrocarbons may have a marked influence upon the detection and identification of microquantities of petroleum or natural gas in the biosphere. Methods have been developed which utilize the hydrocarbon-oxidation activity of microbes as an indirect index of petroleum hydrocarbons in soils and waters. Field and experimental work shows that either natural or artificial introduction of hydrocarbons into these environments almost invariably leads to a biological response. Thus, limitation of microbiological prospecting methods is imposed only by the frequency of seeps from subsurface accumulations of petroleum. — *from* Author's abstract

00604 **Deal, Dwight E.** Karst development and associated mineralization in the Black Hills [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 329-330, 1970.

00605 **Deal, Dwight E.** Solution breccias in Mississippian and Pennsylvanian limestones on the west flank of the Black Hills [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 330, 1970.

00606 **DeGraw, Harold M.** Structure of the northern Denver basin and adjacent uplifts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 330-331, 1970.

Delaune, M. *See* Colmet-Daage, F. 08358

Dellwig, L. F. *See* Wing, R. S. 00941

00887 **DeLong, Stephen E.; Long, Leon E.** Approximate concentrations of trace elements in parent magmas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 279-280, 1970.

00554 **DeMar, Robert.** A primitive pelycosaur from the Pennsylvanian of Illinois: Jour. Paleontology, v. 44, no. 1, p. 154-163, illus., 1970.

A new genus and species of varanopsid pelycosaur, *Milosaurus mccordi*, is described from the Late Pennsylvanian Mattoon formation, Jasper County, Illinois. It is clearly not an ophiacodont because it has a number of advanced features in the pes, vertebrae and ribs. However, its ilium has a dorsal shelf for axial musculature like the ophiacodonts and unlike any known varanopsid. *M. mccordi* is a better morphological intermediate between the sphenacodonts and the ophiacodonts than any other pelycosaur, but it is too late in occurrence and too specialized to be a truly annectent form. The construction of detailed phylogenies of pelycosaurs awaits better collections from strata of Pennsylvanian age. — Author's abstract

00693 **Dennison, John M.; Johnson, Robert W.** Effects of Tertiary intrusions and the thirty-eighth parallel fracture zone in Virginia and West Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 205, 1970.

08253 **Denny, J. R.; Batcha, J. P., Jr.** Newmont computers pay off in mine planning and ore reserve determination [abs.]: Mining Eng., v. 21, no. 12, p. 60, 1969.

Desborough, G. A. *See* Izett, G. A. 00622

08347 **Deutsch, Ernst R.** Paleomagnetism and North Atlantic paleogeography, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 931-954, illus., tables, 1969.

Paleozoic and Mesozoic paleomagnetic evidence is analyzed in terms of some North Atlantic paleogeographic models. Carboniferous, Permian, and Triassic data on divergence of the North American and European apparent polar-wandering curves are compatible with two major rotations since Permian: (1) separation of the continents initially about the polar pivot proposed by Schuchert and Bullard et al. and the northward movement of North America relative to Europe, and continuing

separation since Triassic about a new pivot, perhaps near Wegener's Alaskan one; and (2) a northward 50° displacement of the two continents equivalent to their joint clockwise rotation about a pivot near the equator. Pre-Carboniferous paleomagnetism is inconclusive in testing 'pre-Wegenerian' North Atlantic reconstructions. A paleomagnetic scheme for testing Wilson's concept of a proto-Atlantic is proposed. — VSN

Dever, Garland R., Jr. *See* Philley, John C. 00748

00520 **deVilliers, Johan Pieter Roos.** The crystal structures of aragonite, strontianite, and witherite [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3238B, 1970.

00538 **DeWalle, David Russell.** Disposition of selected late-lying snowpacks in forests of the Colorado Rockies [abs.]: Dissert. Abs. Internat., Secc. B, Sci. and Eng., v. 30, no. 7, p. 3261B, 1970

08394 **Dexter, William A.; Northcutt, Fred; Schulz, Warner.** Spectroscopy as an investigative process in earth science [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 288, 1969.

Dickey, J. S., Jr. *See* Marvin, Ursula B. 00958

00888 **Dickinson, Kendell A.; Hunter, Ralph E.** Grain size distribution and depositional history of northern Padre Island, Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 280, 1970.

Dickinson, William R. *See* Gilbert, Wyatt G. 00614

Dixon, G. *See* Michaelis, E. R. 08228

00607 **Dobrovolny, Ernest.** Geology applied to urban planning in Anchorage and vicinity, Alaska [abs.]: Geol. Soc. Abs. with Programs, v. 2, no. 5, p. 331, 1970.

08288 **Dodge, Charles F.** Stratigraphic nomenclature of the Woodbine Formation, Tarrant County, Texas: Texas Jour. Sci., v. 21, no. 1, p. 43-62, illus., 1969.

The formation consists of a basal shale, a lower sandstone, an upper shale with abundant small sand bodies, and an upper massive sandstone. The basal shale is here named the Rush Creek Member, and the upper sandstone, the Arlington Member. The lower sandstone is Taff's Dexter Sand, and the upper shale, the upper Lewisville. Ten measured sections given include the type sections for both new members. Beds below and above the Woodbine are marine, and disconformable with it. Temporal significance of the surfaces remains to be established, but appears much less significant than previously inferred. The Woodbine is an excellent example of the paralic environment, with offshore bars, channel sands, mud flats, shallow lagoonal deposits, swamp or marsh deposits, and shallow marine blanket sands. A correlation chart for the Woodbine in northern Texas is included. — ESL

00521 **Dolly, Edward Dawson.** Stratigraphic, structural, and geomorphological factors controlling oil accumulation in Upper Cambrian strata of central Ohio [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3238B-3239B, 1970.

00889 **Donath, Fred A.** Contribution of platy minerals to strength variation in anisotropic rock [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 280-281, 1970.

00890 **Donath, Fred A.** Evaluation of apparatus effects in experimental rock deformation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 281, 1970.

00891 **Donnellan, Monica S.** Ca-rich feldspars, unique minerals in Holocene sediments of the Louisiana continental shelf [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 282, 1970.

00892 **Dort, Wakefield, Jr.** A kame of middle Kansan age, Doniphan County, Kansas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 282, 1970.

Dort, Wakefield, Jr. *See* Ratzlaff, John R. 00928

00783 **Douglas, Robert G.** Planktonic foraminifera described from the Upper Cretaceous of California: Cushman Found. Foram. Research Contr., v. 21, pt. 1, p. 18-27, illus., tables, 1970.

Of the 24 Late Cretaceous foraminifer species described from California in the past 40 years, 10 are here considered valid, although three require change of generic designation: *Hedbergella kingi* (Trujillo), *H. beegumensis* and *H. murphyi* Marianos and Zingula, *Praeglobotruncana roddai* (Marianos and Zingula), *Globotruncana churchi* and *G. goudkoffi* Martin, *G. cachensis* Douglas, *Planoglobulina ornatissima* (Cushman and Church), *Bifarina douglasi* Sliter, and *Globotruncana stuartiformis putahensis* Takayanagi (previously described as a species). The remaining taxa, except two yet unnamed species, are synonyms or probable synonyms of species erected outside California. — *from* Author's abstract

08281 **Dowds, John P.** Statistical geometry of petroleum reservoirs in exploration and exploitation: Jour. Petroleum Technology, v. 21, July, p. 841-852, illus., tables, 1969.

Bayes' theorem of conditional probabilities, introduced 200 years ago, has become the foundation for solving geologic problems by statistical approaches. The techniques, models, and case histories presented are some of the new tools for petroleum exploration. — ESL

00694 **Drahovzal, James A.; Copeland, Charles W.** Geologic and hydrologic interpretations of multispectral Apollo 9 space photographs in Alabama [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 206, 1970.

Drake, C. L. *See* Nafe, J. E. 08310

Drake, Charles L. *See* Grim, Muriel S. 00577

Drexler, Wallace W. *See* Benham, Steven R. 00672

08295 **Duane, David B.** Sand Inventory Program — A study of New Jersey and northern New England coastal waters: Shore and Beach, v. 37, no. 2, p. 12-16, illus., 1969.

The Corps of Engineers, through the Coastal Engineering Research Center, is continuing its program of finding and delineating offshore deposits of sand suitable for beach restoration and stabilization. Seismic reflection profiling is supplemented by coring of the bottom. Off New Jersey, the study indicated three billion cubic yards of sand available within a depth of 60 feet; increasing depth to 100 feet would add at least another billion. The New England survey extended from the western end of Long Island Sound to Portland, Maine. The 458 million cubic yards delimited so far is considered a minimum quantity. Areas studied in both regions are described briefly. Federal engineering projects call for 75 million cubic yards of sand, including a 50-year maintenance program; there will also be local needs. — ESL

Dunlop, G. M. *See* Phillips, W. E. A. 08315

00608 **Dunn, Darrel E.** The probability of anomalies on contour maps [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 331-332, 1970.

Dunn, David E. *See* Roper, Paul J. 00760

Dunn, David E. *See* Fish, Johnnie E. 00896

Dunn, James R. *See* Bishko, Donald. 08254

00585 **Durrani, S. A.; Christodoulides, C.; Ettinger, K. V.** Thermoluminescence in tektites: Jour. Geophys. Research, v. 75, no. 5, p. 983-995, illus., tables, 1970.

Glow curves have been obtained for tektites, whose structure is constant and reproducible, showing the glow as a function of temperature. Irradiation of natural samples reinforces, and that of heated samples reinstates, the peaks at their normal positions. Heating markedly enhances the close-response sensitivity of samples. Exposure to UV light results in a severe bleaching of the thermoluminescence glow within a few hours. Isothermal annealing of various glow peaks is studied in detail and an attempt is made to derive from these observations the half-lives and energy depths of electron traps responsible for the glow. Thermoluminescence from surface versus core is not significantly different, indicating that the times of formation and of fall were probably fairly close to each other. Some tentative age estimates are made (a few times 10^9 yr for an indochinite) subject to assumptions discussed in the paper. — GV

08280 **Dworak, Ulf.** Stosswellenmetamorphose des Anorthosits vom Manicouagan Krater, Quebec [Shock metamorphism of the anorthosite from Manicouagan Crater, Quebec] [with English abs.]: Contr. Mineralogy and Petrology, v. 24, no. 4, p. 306-347, illus., tables, 1969.

The central anorthosite peak of the crater displays shock deformation and transition phenomena in plagioclase feldspars, scapolite, apatite, and other maphitic minerals. With increasing shock, a trend to a highly disordered structure of the plagioclase lattice can be observed. Rock fracturing occurs at low pressures. At higher pressures different kinds of isotropization features and planar deformation structures in plagioclase, scapolite, and apatite can be distinguished. These planar elements are glide planes set in motion during shock compression by plastic deformation. At very high pressures a completely isotropic phase, the s. c. diaplectic glass is formed. All of the shock effects can be classified into a low pressure regime, a mixed phase regime, and a high pressure regime. Characteristics of each are described. — *from* Author's abstract

08374 **Dyck, Willy.** Uranium exploration using radon in soils: Canadian Mining Jour., v. 90, no. 8, p. 45-49, illus., table, 1969.

Isotopes of radon are described and emanation discussed. Analytical and sampling methods are given and results shown on graphs. The source of radon in an anomaly observed in the Fortune and Kingsmere Lakes area, in the Gatineau Hills, Quebec, was concluded to be radioactive pegmatites because of correspondence between alpha-activity of radon in soil emanations and gamma-ray activity at the test sites. At Elliot Lake, Ontario, a major uranium producing region, ore crops out in the Quirke zone on the north limb of the syncline and the Nordic zone on the south limb; uranium occurs in conglomerate near the base of the Matinenda. Radon determinations were carried out in soils over both zones. Overburden is 5-15 feet of till and gravel. The radon anomaly is clearly distinguishable and radioactive sources were outlined more clearly than with a Geiger counter. — ESL

00780 **Dziewonski, A.; Landisman, M.** Great circle Rayleigh and Love wave dispersion from 100 to 900 seconds: Royal Astron. Soc. Geophys. Jour., v. 19, no. 1, p. 37-91, illus., tables, 1970.

It is shown that it is possible to obtain Rayleigh and Love wave phase velocities for great circle paths over the period range 100-900 sec from ordinary seismograms of the WWSSN stations. These velocity observations, were obtained by a combination of two techniques: phase delays calculated from time variant filtered segments of the autocorrelogram, and free oscillation periods measured from spectral peaks of the periodogram. The discrepancy between the two sets of Rayleigh wave phase velocities is of the order of 0.003 kmps for periods of 180 to 450 sec after trigonometrical smoothing. Results of Love wave phase velocity measurements were of comparable precision and period range. Comparison with directly measured group velocities shows discrepancies of the order of 0.02 kmps or less; such a severe test of free oscillation observations has never before been presented. — DBV

08321 **Eastler, Thomas E.** Silurian geology of Change Islands and eastern Notre Dame Bay, Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 425-432, illus., 1969.

The Change Islands are underlain by three stratigraphic units of Silurian age. Change Islands Formation (new) is overlain conformably by the North End Formation which is in turn overlain by the South End Formation. The section conforms with the threefold stratigraphic subdivision of the Silurian Botwood Group recognized by Williams (1964). Similarities suggest that this subdivision of graywacke, volcanic rocks, and sandstone can be correlated from Port Albert Peninsula to Little Fogo Islands; the Indian Islands Group may be a time equivalent of the upper Change Islands and North End Formations. Paleographic restoration indicates a trough northwest of Change Islands during Late Ordovician-Early Silurian, with a shelf on the southeast. Subsequently both were filled by volcanic debris and later by terrigenous sediments. — VSN

00609 **Eaton, Gordon P.; Peterson, Donald L.; Schumann, Herbert H.** Luke dome — A halokinetic salt mass near Phoenix, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 332, 1970.

00610 **Eckerty, Donald G.; Vitaliano, Charles J.** Elkhorn Mountains Volcanics — Southernmost facies [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 332-333, 1970.

Edwards, G. S. *See* Rezak, R. 00929

Eggert, Donald A. *See* Frankenberg, Julian M. 08242

08299 **Ehrlich, Marvin; Scharon, H. LeRoy; Mateker, Emil J., Jr.** Vibration analysis and construction blasting, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 13-20, illus., 1969.

Vibration analysis was employed to control the amount of explosives used in highway construction through residential areas. Measurements of the induced ground vibrations were made by portable blast seismographs. The recorded vibrations were analyzed in terms of Crandell's (1949) energy ratio. Crandell's empirical formula relating the amount of vibration transmitted to the weight of explosives detonated at any instant was used to determine the amount of explosives per delay which could be used at a given distance without causing structural damage. — Authors' abstract

Ehrlinger, H. P. *See* Bradbury, J. C. 08252

Eier, Douglas D. *See* Williams, Roy E. 08367

Eittreim, S. L. *See* Jones, E. J. W. 00846

08212 **Eittreim, Stephen; Ewing, Maurice; Thorndike, Edward M.** Suspended matter along the continental margin of the North American basin: Deep-Sea Research, v. 16, no. 6, p. 613-624, illus., 1969.

Vertical profiles of light scattering at 31 stations along the western margin of the North American basin establish the bottom nepheloid layer as a permanent (nonseasonal) feature of the bottom waters of this region in depths greater than 3000 m. Its thickness ranges from 300 to 2400 m, the greatest occurring toward the south off the Blake Plateau and Bahama Islands. Scattering intensities are greatest on the lower continental rise and abyssal plain north of Cape Hatteras. This layer represents sediment in suspension in the southerly bottom current along the western margin. Frequently near the outer ridges, the water is relatively clear adjacent to the bottom under the main nepheloid layer. In the Gulf Stream at about 500 m, the approximate depth of a high gradient in horizontal velocity, a marked increase in light scattering may mark the Sargasso Sea Water-Slope Water boundary. — Authors' abstract

00782 **Ellison, Robert L.; Nichols, Maynard M.** Estuarine foraminifera from the Rappahannock River, Virginia: Cushman Found. Foram. Research Contr., v. 21, pt. 1, p. 1-17, illus., tables, 1970.

Benthonic foraminiferal populations were studied from the estuary and bordering marshes. Two biofacies are recognized in the estuary: a basin biofacies of *Elphidium*

clavatum variants in the lower estuary; a shoal biofacies of *Ammobaculites crassus* in upper reaches, tributaries, and shoals; of the 20 species in the fauna, these two constituted 80 percent of the total (living and dead) population. The biofacies are broadly related to fluctuating estuarine water layers and are separable along a relatively sharp boundary of 15 ppt salinity. In the marshes, an outer biofacies of *Miliammina fusca* and an inner biofacies of *Ammoastuta salsa* occupy relatively salty and fresh water respectively. Total populations increase upstream to a peak in the upper estuary. This study provides a basis for interpreting ancient estuarine deposits of the Atlantic and Gulf coasts. — VMJ

00893 **Ehlk, William C.** Fungal spores in stratigraphy [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 283, 1970.

Ehlk, William C. *See* Fairchild, William W. 08243

00813 **Emiliani, Cesare; Harrison, Christopher G. A.; Swanson, Mary.** Earthquakes and nuclear detonations: Science, v. 167, no. 3920, p. 1013-1014, tables, 1970.

New data are presented in support of the original thesis which has been contested by Anderson and others, Allen and Bailey, and Ryall and Boucher (ibid., p. 1011-1013). The new data strongly suggest that seismic activity was indeed stimulated in this region. It is noted that neither the original data nor the new can be interpreted as a "rediscovery" of the dubious 24-hour period as suggested by Anderson and others. Further, the new data show the model put forth by Ryall and Boucher to be incorrect. In reply to Allen and Bailey, it is pointed out that underground nuclear tests conducted so far presumably have been made at locations and depths chosen to avoid release of large amounts of seismic energy. It is still contended that tests conducted at suitable locations and depths could trigger release of large amounts of seismic energy in which energy output would exceed input. Only if this were the case could underground nuclear explosions be used to control earthquakes. — GV

08392 **Emmett, L. F.; Jeffrey, H. G.** Reconnaissance of ground-water resources of the Missouri River alluvium between Jefferson City and Miami, Missouri: U.S. Geol. Survey Hydrol. Inv. Atlas HA-340, scale 1:125,000, text, 1969.

Ground water available to wells between Jefferson City and Miami occurs in openings between sand and gravel particles making up the Missouri River alluvium, under both water-table and artesian conditions which vary geographically and in time. Withdrawal represents a small fraction of water available to wells. Several irrigation wells have reported yields of 1,000 gpm; municipal wells are pumped at rates of less than 300 gpm, although reported capacities range from 25-65 gpm per foot of drawdown. Water is characterized by high hardness and iron content. Amount of water from natural storage can be increased in some areas by locating a well so it induces recharge from the river. Chief problems to further development are encrustation of well screens and excessive drawdowns caused by placing wells too close to each other. — MCM

00496 **Epps, Lawrence W.** Calculated size of ancient Brazos River from terrace gravel and meander geometry [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 335-336, 1970.

00695 **Epstein, Claude M.** Brachiopod shell morphology and its relationship to environment — A Q-mode factor analysis of the brachiopods of the Helderberg Group (Lower Devonian) of New York [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 206, 1970.

08402 **Epstein, Jack B.** Surficial geology of the Stroudsburg quadrangle, Pennsylvania-New Jersey: Pennsylvania Geol. Survey, 4th ser., Bull. G 57 (Gen. Geology Rept.), 67 p., illus., tables, geol. map, 1969.

In this Valley and Ridge area, two glaciations are indicated by a deeply weathered Illinoian (?) till, and fresher till and melt-water deposits of Wisconsin age. A northeastward ice-margin retreat is inferred from conspicuous terminal moraine and widespread thick ground moraine; deglaciation phases are tentatively correlated by

large kames alined with ice-contact deposits to the north. Levels of glacial Lake Scotia's stratified deposits indicate its outlet was first at Saylorsburg, later at Delaware Water Gap. Ice-flow direction, shown on bedrock surfaces to average S 20° W, is corroborated by pebble counts in postglacial deposits of numerous drainage changes. Degree of sorting is statistically measured; X-ray diffraction analyses show quartz and feldspar more abundant than clay minerals in silt sizes. Sand and gravel, peat, and waste slate are of proven or potential economic value. — GDC

Epstein, Samuel. *See* Savin, Samuel M. 00949

Epstein, Samuel. *See* Savin, Samuel M. 00974

08258 **Erickson, Alvin J., Jr.** Discovery and development of the "North Ore Zone" Ontario mine, Park City district, Utah [abs.]: Mining Eng., v. 21, no. 12, p. 64, 1969.

00659 **Ernst, W. G.** Tectonic contact between the Franciscan mélange and the Great Valley sequence—Crustal expression of a late Mesozoic Benioff zone: Jour. Geophys. Research, v. 75, no. 5, p. 886-901, illus., 1970.

The structural break between Late Mesozoic Franciscan rocks of the California Coast Ranges and the Great Valley miogeosynclinal strata to the east has been interpreted as the crustal expression of a late Mesozoic Benioff zone. Episodic or relatively continuous underthrusting of the trench mélange beneath this former seismic shear zone is held responsible for the contrasting characteristics of Franciscan rocks and simultaneously deposited Great Valley sequence as well as for their tectonic juxtaposition. A speculative four-state tectonic model is proposed involving Late Jurassic spreading of the Pacific Ocean floor, mid-Cretaceous buoyant uplift of parts of the eugeosynclinal prism, post-Cretaceous convergence between oceanic and continental lithospheric plates and Miocene-Pleistocene diapiric uplift of the Franciscan melange related to northwestward seafloor spreading.—GV

Ernst, W. Gary. *See* Brace, William F. 00870

Eslinger, Eric V. *See* Huffman, Samuel F. 00721

08401 **Esmer, Erkan.** The freezing and thawing mechanisms in lime stabilized soils [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2676B, 1969.

00696 **Espenshade, Gilbert H.; Rankin, Douglas W.** Probable Precambrian crystalline rocks in the Sauratown Mountains anticlinorium, a major structural feature in the Piedmont of North Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 207, 1970.

00552 **Estes, Richard.** The status of *Palaeosiren beinerti*, a supposed Permian aistopod amphibian: Jour. Paleontology, v. 44, no. 1, p. 140-141, 1970.

Palaeosiren beinerti Geinitz (1864), a presumed Lower Permian aistopod amphibian from Czechoslovakia (CSR), was cited by its author to resemble the Recent salamander *Siren*. The unique specimen on which this name is based is a sedimentary structure resulting mainly from dolomite infiltration of the shale slab. It is thus not a fossil, although carbonaceous stains may indicate that plant material was once present. The name *Palaeosiren benerti* is excluded from zoological nomenclature since it was not based on organic remains. — Author's abstract

Ethridge, Frank G. *See* Davies, David K. 00886

Ettinger, K. V. *See* Durrani, S. A. 00585

00697 **Eutsler, Robert L.** Algal borings, homogenization, and porosity in Recent limestone of the lower Florida Keys [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 297-208, 1970.

08277 **Evans, Bernard W.; Shaw, Denis M.; Haughton, David R.** Scapolite stoichiometry: Contr. Mineralogy and Petrology, v. 24, no. 4, p. 293-305, illus., tables, 1969.

Over the range Ca/(Ca+Na) from zero to 0.75, scapolites vary linearly between $Na_4Al_3Si_9O_{24}Cl$ and $NaCa_3Al_5Si_7O_{24}CO_3$, by means of a coupled replacement of Na_2Si_2Cl by $Ca_2Al_2CO_3$. From Ca/(Ca+Na) = 0.75 to 1.00, variation is between $NaCa_3Al_5Si_7O_{24}CO_3$ and $Ca_4Al_6Si_6O_{24}CO_3$ by means of a coupled replacement of NaSi by CaAl, as in plagioclase. Anion substitution is complete at 0.75. Recalculation of scapolite analyses on the basis of Al + Si atoms = 12.0, as suggested by computed unit cell contents, offers a reasonable basis for normalization of atomic proportions. On this basis, Ca + Sr + Na + K + Fe atoms total very close to 4.0. Subdivision of scapolites at Ca/(Ca + Na) ratios of 0.25, 0.5, and 0.75 seems more logical than the 0.2, 0.5, and 0.8 limits used hitherto. — *from* Authors' abstract

00841 **Evans, Hilton B.** Status and trends in logging: Geophysics, v. 35, no. 1, p. 93-112, illus., 1970.

Introduction of new logging devices by logging service companies is being limited because oil companies are standardizing logging suites run in various operating areas. Standard logging suites and evaluation and techniques that have recently evolved can be evaluated in terms of open- and cased-hole applications and the physical parameters of interest. Generally, they depend on differences in response of multiple electrical and porosity devices. The multiple measurements are input to response equations which yield the parameters of interest. Use of logging devices and interpretation methods in nonpetroleum mineral exploration and evaluation and in providing geophysical survey parameters is increasing. Log digitizing and computer processing of data have become routine in most major oil companies. Current research and development emphasis is on pulsed neutron spectroscopy, acoustic-parameter measurements, and digital processing techniques. — GV

00588 **Evernden, J. F.** Magnitude versus yield of explosions: Jour. Geophys. Research, v. 75, no. 5, p. 1028-1032, illus., tables, 1970.

A graphical plot is given relating explosive yield to seismic magnitude for the following situations: detonation of the explosive in alluvium (well above water table), in valley tuff, mesa tuff, hard rock, salt, and water. Shots below water table are discussed and some comments on the magnitude calculations and the proper mode of application of the "Y" versus "m" figure (the above mentioned graphical plot) are made. — GV

Ewing, B. B. *See* Kown, B. T. 08407

Ewing J. I. *See* Jones, E. J. W. 00846

Ewing, M. *See* Jones, E. J. W. 00846

Ewing, Maurice. *See* Eittreim, Stephen. 08212

00522 **Eyrich, Henry Theodore.** Economic geology of part of the New World mining district, Park County, Montana [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3239B, 1970.

00698 **Faas, Richard W.** Consolidation characteristics of estuarine sediments [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 208, 1970.

00894 **Facundus, Michael R.; Moore, Clyde H., Jr.** Model for solution brecciation and attendant calcitization of dolomite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 283, 1970.

Fagan, James. *See* Carpenter, Robert Heron. 00682

Fahnestock, Robert K. *See* Bradley, William C. 00597

08243 **Fairchild, William W.; Elsik, William C.** Characteristic palynomorphs of the lower Tertiary in the Gulf Coast: Palaeontographica, Abt. B., v. 126, nos. 3-6, p. 81-89, illus., 1969.

Wilcox assemblages are characterized by the abundance and variety of triporate, triatriate, and tricolporate pollen, and more specifically by the youngest occurrence of *Choanopollenites*, *Sercapollenites*, and *Thomsonipollis*. Several genera and species of the Normapolles group occur commonly in the older Wilcox and Midway, but the abundance and diversity of these forms decreases in younger horizons; only one species, *Nudopollis terminalis* occurs regularly in the Claiborne Group. Wilcox assemblages closely resemble those from the Paleocene and earliest Eocene of central Europe. The pollen genera *Anacolosidites*, *Duplopollis*, *Ephedra* (*distachya*-type), *Gothanipollis*, *Symplocoipollenites*, and a Restionaceous-type occur commonly in the middle and late Eocene of the Gulf Coast and central Europe but only rarely in the Wilcox Group. — *from* Authors' abstract

08203 **Fairhall, A. W.** Concerning the source of the excess ^3He in the sea: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 249-250, 1969.

A significant fraction, if not all, of the excess He-3 found by Clarke, Beg, and Craig in the deep sea is attributed to the decay of tritium. — Author's abstract

00699 **Falls, Darryl L.; Textoris, Daniel A.** Size, grain type, and mineralogical relationships in Recent marine calcareous beach sands [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 208, 1970.

08362 **Fang, J. H.; Townes, W. D.; Robinson, P. D.** The crystal structure of manganese metagermanate, $MnGeO_3$ [with German abs.]: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 139-147, tables, 1969.

The crystal structure of manganese metagermanate, $MnGeO_3$, has been refined. Two independent sets of three-dimensional x-ray intensities were measured. The crystallographic data are: a=19.267, b=9.248, c=5.477 A; Z=16; and space group *Pbca*. The compound is isotypic with enstatite, $MgSiO_3$. Using the positional parameters of enstatite as a starting point, the structure was refined to R_F=0.08. The essential feature of the structure is the linkage of GeO_4 tetrahedra to form single chains running parallel to the c axis. The chains are bound together by manganese octahedra. There are two crystallographically different chains, arranged with the vertices of alternate tetrahedra pointing in opposite directions. Average Ge-O and Mn-O distances are 1.75 and 2.21 A respectively. — Authors' abstract

00802 **Fanshawe, John R.** Memorial to Pierre Pruvost (1890-1967): Geol. Soc. America Proc. 1967, p. 243-251, portrait, 1970.

Fatt, Irving. *See* Weinbrandt, R. M. 08270

Ferm, John C. *See* Horne, John C. 00716

00895 **Ferrell, Ray E., Jr.** Carbonate-clay mineral associations on Quaternary sediments, Louisiana continental shelf [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 284, 1970.

08364 **Field, Michael E.** Iron sulfide formation and cementation in deep-sea sands [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 85, no. 4, p. 124, 1969.

08221 **Finch, William C.** Abnormal pressure in the Antelope field, North Dakota: Jour. Petroleum Technology, v. 21, July, p. 821-826, illus., 1969.

In the Antelope field, a southeast spur of the Nesson Anticline field, abnormally high pressures were encountered in the Sanish zone. It is concluded that this is a local phenomenon and the pressure is induced by tectonic forces during structural growth, and may be expected in other parts of the Williston basin wherever similar structural and stratigraphic conditions exist. — ESL

00810 **Finkelman, R. B.** Magnetic particles extracted from manganese nodules — Suggested origin from stony and iron meteorites: Science, v. 167, no. 3920, p. 982-984, illus., table, 1970.

On the basis of x-ray diffraction and electron microprobe data, spherical and ellipsoidal particles extracted from manganese nodules were divided into three groups. Group I particles are believed to be derived from iron meteorites, and Group II particles from stony meteorites. Group III particles are believed to be volcanic in origin. — Author's abstract

00896 **Fish, Johnnie E.; Dunn, David E.; Muehlberger, William R.** Crustal structure of the central Texas Gulf Coastal Plain [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 284, 1970.

08421 **Fisher, David.** Dating the spreading sea floor: New Scientist, v. 44,no. 672, p. 185-187, illus., 1969.

Poor results have been obtained from K-Ar age determinations on deep-sea rocks, probably because of the presence of large amounts of 'excess' Ar-40. Relatively good results have been obtained, however, using the fission-track method. The 'excess' Ar-40 in deep-sea basalts is explained as an effect of the rapid cooling of flows when extruded on the ocean floor, and although diminishing the value of dating, the excess gas opens up new areas of research in rare-gas abundance of the deep Earth. K-Ar ages may be used to establish the upper limits to ages of eruptions on the sea floor. It is emphasized that volcanism on the ocean floor is not confined to the crest of active ridges but is a general feature of the sea floor. To test sea-floor spreading, lava flows which form the actual sea-floor bottom and not the sea mountains, which spring up from this bottom, must be dated. — VSN

Fisher, Donald W. *See* Funk, Robert E. 00963

00700 **Fisher, Irving S.** Relation of trace strontium to the calcite, dolomite, and insoluble fractions of central Kentucky Ordovician limestones [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 208-209, 1970.

00790 **Fisher, Irving S.** Selective removal of dolomite from a limestone host by weathering [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 209, 1970.

00819 **Flanagan, F. J.** Sources of geochemical standards — II: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 121-125, tables, 1970.

A revised and enlarged list of rock, mineral, ore, industrial product, counting, and isotopic standards of interest to those in geochemistry and geology is presented. Samples in process are also included. Sources from which the samples may be obtained are listed. — Author's abstract

00611 **Fleck, Robert J.** Age and possible origin of the Las Vegas Valley shear zone, Clark and Nye Counties, Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 333, 1970.

Fleetwood, Arthur R. *See* Saucier, Roger T. 00562

08393 **Floyd, Edwin O.** Ground-water resources of Craven County, North Carolina: U.S. Geol. Survey Hydrol. Inv. Atlas HA-343, 2 sheets, scale about 1 in. to 4 mi., section, text, 1969.

The sheets contain maps showing: piezometric surface of aquifer 2 and areas where aquifer 2 receives recharge from aquifer 1; selected water analyses of areas where aquifers contain water suitable for public use; and depths to top and bottom of aquifers and significant chemical content of water in each. Sediments between basement rocks and water table are saturated with water and together form one continuous ground-water reservoir; eight sand and limestone aquifers have been identified. Recharge occurs everywhere except along lower parts of stream valleys. Pumping tests to determine hydraulic properties of aquifers are summarized. As conditions affecting development of ground-water supplies vary locally, steps involved in determining depth and well size for a hypothetical water supply are enumerated. All ground water contains some dissolved mineral matter. — MCM

08301 **Foose, Richard M.** Mine dewatering and recharge in carbonate rocks near Hershey, Pennsylvania, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 45-60, illus., 1969.

Mining of high-calcium limestone from the overturned, south-dipping beds of the Annville Limestone resulted in large withdrawals of ground water from beneath the Hershey Valley, particularly when the mining operation was deepened in 1949. Details of ground-water movement, water levels, and the position and size of cones of depression caused by pumping reveal drastic differences before and after mine deepening. A program of ground-water recharge to restore ground-water levels by the Hershey Chocolate Corporation resulted in litigation. Continued recharge coupled with a grouting program by the mine resulted in the restoration of normal water levels. — Author's abstract

08194 **Foote, R. S.** Review of radiometric techniques in petroleum exploration, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 43-55, illus., table, 1969.

Recently, highly sensitive airborne gamma-ray spectrometers have been developed which allow accurate determination of the separate contributors to the natural gamma-radiation flux: Bi-214, Tl-208, and K-40. New methods which include corrections for cosmic radiation and for contributions from radon in the atmosphere, make possible closely reproducible measurements and development of meaningful low-order anomalies. Results from airborne-exploration programs show that, for uranium minerals, 30-70 percent of the total measured gamma radiation from uranium daughters originate in the atmosphere, and that diurnal variations in total Bi-214 radiation may exceed 100 percent. The status of equipment-development and data-processing techniques is now sufficiently advanced to allow new, highly-controlled experimental verifications of possible usefulness of gamma-radiation measurements in petroleum exploration. — *from* Author's abstract

00701 **Fountain, Richard C.; Zellars, Michael E.** A program for ore control in the central Florida phosphate district [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 209-210, 1970.

00702 **Fowler, Michael L.; Atkinson, Lee C.; Gill, Dan; Keer, Frederick R.; Raring, Andrew M.** Biota and sediment in a small lagoon on Big Pine Key, Florida [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 210, 1970.

Frakes, Lawrence A. *See* Crowell, John C. 00960

00587 **Francheteau, Jean; Sclater, J. G.** Comments on paper by E. Irving and W. A. Robertson, "Test for polar wandering and some possible implications" [1969]: Jour. Geophys. Research, v. 75, no. 5, p. 1023-1027, illus., tables, 1970.

This paper questions the validity of the test for polar wandering proposed by Irving and Robertson (ibid, v. 74, no. 4, p. 1026-1036, 1969). In essence, the suggested test assumes that an absolute frame of reference exists in which one can measure the motion of the plates with respect to the North Pole when their motion with respect to one another is known. It is shown that the discrepancies found by Irving and Robertson are the fruit of this assumption, which is neither valid nor workable. — DBV

08242 **Frankenberg, Julian M.; Eggert, Donald A.** A petrified *Stigmaria* from North America — Pt. 1, *Stigmaria ficoides*, the underground portions of Lepidodendraceae: Palaeontographica, Abt. B, v. 128, nos. 1-2, p. 1-47, illus., 1969.

A review of the history of knowledge about *Stigmaria* is followed by a synopsis of the known stigmarian features. This study elucidates the major morphological and anatomical features of the stigmarian axis and lateral appendages from North American coal balls, from Illinois, Indiana, Kentucky, and Kansas, and of Pennsylvanian age. A complete description is given of all of the parts of *Stigmaria ficoides*, which is the underground portion of a considerable number of lycopods, most likely Lepidodendraceae. — HRC

Friedman, Melvin. *See* Gallagher, John J. 00897

08334 **Friend, P. F.** Tectonic features of Old Red sedimentation in North Atlantic borders, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 703-710, illus., 1969.

Devonian sediments are studied as a starting point in analysis of late orogenic movements in the Caledonian-Appalachian mobile belt. It is assumed that this belt drifted apart after Devonian. Sequences of 14 main Devonian outcrop areas, from Spitsbergen to New York State, provide evidence of times of deposition and erosion in marine or nonmarine environments and rates of sedimentation. The Old Red landmass grew southeastward in late Silurian and Early Devonian times in Scandinavia and Britain; later in Devonian, it grew westward in the Appalachians. Times of growth were coincident with the main Caledonian and Acadian phases of deeper crustal mobility. Geometry of movement of individual basins within the landmass is analyzed by use of paleocurrents, facies variation, provenance of sediments, and thickness variations. — *from* Author's abstract

00703 **Fullagar, Paul D.; Bottino, Michael L.** Weathering's effect on Rb-Sr whole-rock ages [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 210-211, table, 1970.

00963 **Funk, Robert E.; Fisher, Donald W.; Reilly, Edgar M., Jr.** Caribou and Paleo-Indian in New York State — A presumed association: Am. Jour. Sci., v. 268, no. 2, p. 181-186, illus., 1970.

A cave near Florida, Orange County, New York, has yielded caribou bones and a fluted point in the same stratum. Radiocarbon dating of the bones produced an age of 10,580 B.C. ± 370 years. In the same region mastodon, and moose-elk bones have been dated at 8050 B.C. ± 160 years and 9000 B.C. ± 150 years, respectively. Similar dates have been obtained for mastodon remains farther upstate. There is, thus, the strong likelihood that New York's Paleo-Indians hunted caribou; they may also have hunted mastodon and moose-elk. — Authors' abstract

Fusil, G. *See* Colmet-Daage, F. 08358

00897 **Gallagher, John J.; Sowers, George M.; Friedman, Melvin.** Photomechanical model studies relating to fracture in granular rock aggregates [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 285, 1970.

08417 **Ganis, G. R.** A new *Tempskya* locality from North Carolina [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 85, no. 4, p. 123, 1969.

Gantnier, Robert F. *See* Tourtelot, Harry A. 00648

00523 **Gard, Theodore Max.** Tectonics of the Badwater uplift area, central Wyoming [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3239B-3240B, 1970.

Gardner, J. K. *See* Knopoff, Leon. 08376

00704 **Gardner, L. R.** A chemical model for the origin of gibbsite from kaolinite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 211, 1970.

00898 **Garrison, Louis E.; Berryhill, Henry L., Jr.** Possible seaward extension of the San Marcos arch [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 285-286, 1970.

00831 **Gaskell, T. F.** Physics of the Earth: New York, Funk and Wagnalls, 216 p., illus., 1970.

Although the origin of the Earth is still in doubt, new knowledge of the planet is enlarging the capacity to change the world we live in; therefore it is important to learn

the fine details of the ways in which nature operates before doing something to upset natural balances that have taken many millions of years to become established. Sections of this book are titled: Earth's origin, drifting continents, plastic mantle, magnetism and the core, ocean floor, earthquakes and volcanoes, mountain building, and uses and abuses of geophysics. A glossary, a select bibliography, sources of illustrations, and an index are appended. — MCM

08298 **Gaskins, John W.; Cleaves, Arthur B.** Jim Woodruff Dam — Changed conditions claim, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 7-12, illus., 1969.

Government construction contracts possess a changed condition clause which empowers the contracting officer to make an equitable adjustment in the contract price if subsurface conditions actually encountered were unknown and differed materially from those indicated. The invitation for bids for a powerhouse located in a river bed [in Florida] had estimated the quantity of cofferdam pumping at 625,000 units of 1,000 gallons each, which the contractor believed to be grossly inadequate. He accordingly based his bid on the premise that a much larger quantity of pumping would be required. Where actual performance proved the contractor right, the quantity of water pumped exceeding the Government's estimate by 10 times, was the Government justified in unilaterally declaring the existence of a changed condition and in reducing the contract unit price for pumping from 40 to 8 cents per thousand gallons? — *from* Authors' abstract

08326 **Gates, Olcott.** Lower Silurian-Lower Devonian volcanic rocks of New England coast and southern New Brunswick, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 484-503, illus., 1969.

Remnants of a chain of volcanic centers within Early Silurian-Early Devonian marine waters of the northern Appalachian geosyncline are exposed along the New England coast and in southern New Brunswick. Coastal volcanics vary in thickness and lithologic succession, and are largely fragmental andesites to rhyolites now altered to keratophyre and quartz keratophyre; basalt flows are present. Sedimentary rocks include shale and siltstone with shallow-water benthic faunas. Folding, faulting, and plutonic intrusion of granitic and gabbroic magmas occurred in the Acadian orogeny in Middle Devonian. In the Carboniferous and Triassic NE-trending faults shuffled together blocks of different age. Thus, the Lower Silurian-Lower Devonian volcanic belt marks the beginning of a zone of weakness in the continental crust below the northern Appalachian geosyncline. — *from* Author's abstract

00550 **Gauri, K. L.; Boucot, A. J.** *Cryptothyrella* (Brachiopoda) from the Brassfield Limestone (Lower Silurian) of Ohio and Kentucky: Jour. Paleontology, v. 44, no. 1, p. 125-132, illus., 1970.

Cryptothyrella bisulcata, n. sp., from Adams County, Ohio, is characterized by a medial sulcus on each valve. *C. subquadrata* (Foerste) is placed in synonymy with *C. quadrangularis* (Foerste). Geopetal structures of the latter species indicate living position with umbones down. Shell structure in both species consists of outer fibrous and inner prismatic layers in a consistent arrangement. — REG

Gautheyrou, J. *See* Colmet-Daage, F. 08358

Gautheyrou, M. *See* Colmet-Daage, F. 08358

08389 **Gazin, C. Lewis.** A new occurrence of Paleocene mammals in the Evanston Formation, southwestern Wyoming: Smithsonian Contr. Paleobiology, no. 2, 17 p., illus., 1969.

A new fossil horizon and locality for the Evanston Formation, near Little Muddy Creek in the Fossil Basin, has yielded a mammalian faunule of middle Paleocene age. Relationships are shown to the two widely separated classic middle Paleocene occurrences — the upper Lebo fauna of the Fort Union Group in Montana and the Tor-

rejon fauna in New Mexico. Correlation is also indicated with the Battle Mountain and Rock Bench faunas in Wyoming. The known faunule is composed of about 15 elements of small mammals representing the orders Multituberculata, Insectivora, Primates, Creodonta, and Condylarthra. The material consists mostly of isolated teeth, hence identifications are tentative. One new species is described, *Aphronorus orieli*, a pantolestid. — *from* Author's abstract

Geddes, Wilburt H. *See* Best, David M. 00675

Geiss, J. *See* Alder, B. 08396

Ghent, E. D. *See* Jones, J. W. 00755

00614 **Gilbert, Wyatt G.; Dickinson, William R.** Stratigraphic variations in sandstone petrology, Great Valley sequence, central California coast: Geol. Soc. America Bull., v. 81, no. 3, p. 949-954, illus., tables, 1970.

West of the Sur-Nacimiento fault zone in the Southern Coast Ranges of California, strata of the Great Valley sequence are exposed in thrust plates resting tectonically on the underlying Franciscan assemblage as is the case east of the San Andreas fault. Detrital modes of sandstones from different horizons in the local sequence show the same systematic variations with stratigraphic position as do correlative late Mesozoic strata in the main outcrop belt along the west side of the Great Valley. The similar tectonic setting and sandstone petrology suggest the rocks in the two areas are parts of a single extensive terrane separated by fault offset in the Cenozoic. — Author's abstract

Gill, Dan. *See* Fowler, Michael L. 00702

00617 **Gilles, Albert P.; Mathisrud, Gordon C.** Computerized ore estimating at Homestake [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 333-334, 1970.

00705 **Glass, F. R.** The relationship of the Christiansburg-Radford, Virginia, window complex to the underlying anticlinorium [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 211-212, 1970.

08205 **Goldstein, Myron A.; Strangway, D. W.; Larson, E. E.** Paleomagnetism of a Miocene transition zone in southeastern Oregon: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 231-239, illus., table, 1969.

A transition in the Earth's magnetic field, recorded in a sequence of basaltic lavas in southeastern Oregon (15.1 ± 0.3 m.y.), has been investigated. The reversal pattern is similar at the various sample sites (up to 55 miles apart) and the apparent paleo-intensity ranges from 0.5 Oe outside the transition to a minimum of 0.025 Oe inside the transition. This range is somewhat greater than that reported in other studies of transition zones. Similarity in transition pattern at widely separated locations indicates that crustal magnetic anomalies could not have given rise to the recorded field. It is probable that the main dipole field and/or nondipole centers were the primary features influencing acquisition of TRM during the transition. — Authors' abstract

08213 **Gordon, Donald C., Jr.** Examination of methods of particulate organic carbon analysis: Deep-Sea Research, v. 16, no. 6, p. 661-665, illus., tables, 1969.

A procedure is described for calculating confidence limits of individual particulate organic carbon analyses. Sampling and analytical methods currently in use are compared. — Author's abstract

00966 **Gordon, T. M.; Greenwood, H. J.** The reaction — dolomite + quartz + water = talc + calcite + carbon dioxide: Am. Jour. Sci., v. 268, no. 3, p. 225-242, illus., tables, 1970.

The reaction has been studied at temperatures from 400° to 520°C at 2000 bars. It involves coexisting dolomite and calcite, and consequently the free energy change of the reaction is dependent upon the solid solubility of $MgCO_3$ in calcite. Data of previous investigators have been used to derive the activity coefficient of $MgCO_3$ in calcite. This equation and data on the composition of coexisting calcite and dolomite have been used to determine the standard free energy change of the reaction. Talc forms as the first step in the metamorphism of siliceous dolomites only in the absence of potassium and aluminum. Presence of aluminum alone leads to the early formation of chlorite, and presence of both leads to early formation of phlogopite. — *from* Authors' abstract

00518 **Gordon, W. A.** Contrasts in Jurassic biogeographic patterns [abs]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 334, 1970.

00959 **Gould, Stephen Jay.** History versus prophecy — Discussion with J. W. Harrington [of two papers by Harrington, 1967, 1969]: Am. Jour. Sci., v. 268, no. 2, p. 187-189, 1970.

The use of the history of science as practiced by Harrington (ibid., v. 265, p. 449-461; v. 267, p. 292-297) is incorrect, as scriptural references should be considered in their historical context. The references by Isaiah to filling and cutting are to road-building operations rather than geomorphologic interpretations of the arid cycle as suggested by Harrington. — HRC

Grant, Richard E. *See* Stehli, Francis G. 00547

Grant, Richard E. *See* Cooper, G. Arthur. 08424

08209 **Greene, John C.** The development of mineralogy in Philadelphia, 1780-1820: Am. Philos. Soc. Proc., v. 113, no. 4, p. 283-295, 1969; *summary in* Toward a history of geology (C. J. Schneer, editor) — New Hampshire Inter-Disciplinary Conf. History of Geology, 1967, Proc.: Cambridge, Mass., and London, M.I.T. Press, p. 184-185 1969.

Medical schools provided one avenue by which mineralogy, as an adjunct of chemistry, entered academic curricula in the United States. It failed to take hold at the University of Pennsylvania, however, although James Woodhouse gave some attention to analysis of minerals, Adam Seybert brought back from Paris a cabinet of minerals, and his son, Henry, published some good papers on mineralogy. Thomas Cooper taught it and geology to undergraduates there from 1816 to 1820. The American Philosophical Society gradually accumulated a sizable collection, arranged by Godon, a Parisian mineralogist, but was not a major center of mineralogical research. The Linnaean Society gave short-lived prominence to mineralogy in its activities. The Academy of Natural Sciences was more successful due to interests of its first two presidents, Troost and Maclure; it acquired the collections of Seybert and Godon, and through its *Journal* mineralogy became firmly established. — GDC

Greenwood, H. J. *See* Gordon, T. M. 00966

Greenwood, W. R. *See* Reid, R. R. 00568

Greer, Randall E. *See* Bischoff, James L. 00981

Gresens, Randall L. *See* Stensrud, Howard L. 00647

00954 **Grew, Edward S.; Mamay, Sergius H.; Barghoorn, Elso S.** Age of plant fossils from the Worcester coal mine, Worcester, Massachusetts: Am. Jour. Sci., v. 268, no. 2, p. 113-126, illus., table, 1970.

Identifiable plant remains from the Worcester coal mine include neuropterid pinnules, a seed, which is most likely of cordaitean affinity, calamarian stems, and cordaitean foliage. The assemblage is post-Devonian, and most likely of Early and Middle Pennsylvanian age. This age is inconsistent with field relations observed in the

area and with recently-determined radiometric ages on the Ayer Granite. The new evidence suggests that many of the metasedimentary rocks of the Worcester area are pre-Carboniferous and that an unconformity exists between the older formations and the established Carboniferous rocks. As the fossilferous rocks have been metamorphosed, good stratigraphic evidence is provided for extending the known area of the post-Pottsville orogenic events in south-central New England. — *from* Authors' abstract

00513 **Grigg, Neil Sadler.** Motion of single particles in sand channels [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3192B, 1970.

00577 **Grim, Muriel S.; Drake, Charles L.; Heirtzler, James R.** Sub-bottom study of Long Island Sound: Geol. Soc. America Bull., v. 81, no. 3, p. 649-665, illus., 1970.

Seismic reflection and refraction measurements, a contoured magnetic map, and surface and borehole geologic data are combined to provide details on the Pleistocene history of the area of Long Island Sound. Relief of many hundreds of feet is present in the primarily Cretaceous cover over the basement and beneath the Pleistocene deposits. The magnetic data indicate that the Triassic rocks of Connecticut extend beneath the Sound at least to its south shore. — AG

00706 **Grinnell, Robert S., Jr.** Structure and development of oyster reefs off the Suwannee River delta, Florida [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 212, 1970.

00707 **Griswold, T. B.** The theoretical prediction of the effect of water pressure on eutectic systems and its application to systems of geologic interest [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 212-213, 1970.

Griswold, Thomas B. *See* Brown, William R. 00679

Groegler, N. *See* Alder, B. 08396

Gualtieri, J. L. *See* Weir, G. W. 00774

08278 **Guilcher, André.** Un domaine de sédimentation calcaire—La baie et les keys de Floride et les milieux environnants [with English abs.]: Annales Géographie, v. 78, no. 429, p. 513-528, illus., 1969.

Carbonate sedimentation is dominant in Florida Bay and surrounding areas. A Pleistocene (Sangamon) sequence representing facies deposited penecontemporaneously, includes from east to west, coral reefs of the Florida Keys, Miami oolitic ridge, and a bryozoan facies; deposits of the Great Bahama Bank form a Holocene counterpart. The southern Florida Holocene sequence, from east to west, consists of: reef tract, comprising the outer living reef and the back reef; Florida Bay, with fine calcareous mud supplied chiefly by the green alga *Penicillus*; Cape Sable, with a quartzose fraction greater than elsewhere; Whitewater Bay and the Everglades, where fibrous peat overlies a basal calcitic mud which rests on the Pleistocene Miami oolite or bryozoan facies. Brief comparisons are made with other tropical and temperate calcareous environments. — VMJ

08273 **Güven, Necip.** Nature of the coordination polyhedra around M2 cations in pigeonite: Contr. Mineralogy and Petrology, v. 24, no. 3, p. 268-274, illus., tables, 1969.

As shown by "unfolding" the silica chains in pigeonite, cations with octahedral stereochemistry like Mg^{++} and Fe^{++} cause "kinking" of the silica chains, whereas larger cations like Ca^{++} and Na^{+} have an opposite, namely "straightening," effect. This is a probable factor causing immiscibility in the Mg^{++}-Ca^{++} solid solutions in pyroxenes. In pyroxene structures with "kinked" silica chains the arrangement of oxygen atoms approaches "close packing;" consequently different stacking sequences will be energetically possible leading to polymorphism in pyroxenes. — *from* Author's abstract

08245 **Haas, George.** On the jaw muscles of ankylosaurs: Am. Mus. Novitates, no. 2399, 11 p., illus., 1969.

Two ankylosaur skulls and their mandibular rami, from the Cretaceous Oldman Formation along the Red Deer River below Steveville, Alberta, were studied. Muscles are described in the following order: the adductor externus group, including the levator anguli oris; the adductor posterior; and the adductor mandibulae internus group, including pseudotemporalis and pterygoideus muscles, all innervated by the trigeminal nerve. The muscle depressor mandibulae, innervated by the facialis nerve is also discussed. The whole muscular system was not very strong for such a massive skull; these dinosaurs probably ate soft vegetable food. — ESL

00708 **Hadley, Jarvis B.** Origin of some layered gneisses of the western Carolina Piedmont [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 213-214, 1970.

Hagmaier, J. Ladd. *See* Clayton, Lee. 00600

00754 **Hagmaier, J. Ladd.** Relation of uranium occurrences to groundwater flow systems in the Powder River Basin, Wyoming [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 334-335, 1970.

00524 **Halbig, Joseph Benjamin.** Trace element studies in synthetic sulfide systems — The solubility of thallium in sphalerite and the partition of selenium between sphalerite and galena [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3240B, 1970.

00709 **Hale, Robin C.** Factors favoring Precambrian Ocoee sediments as a source of gold for auriferous quartz veins in the Coker Creek district, Monroe County, Tennessee [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 214, 1970.

08324 **Hall, Bradford A.** Pre-Middle Ordovician unconformity in northern New England and Quebec, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 467-476, illus., 1969.

Oldest known rocks exposed within the Munsungun anticlinorium of north-central Maine are Cambrian (?) and Middle Ordovician. Age of the Cambrian (?) rocks is inferred from stratigraphic position and physical correlation with rocks in Maine, Vermont, and Quebec. Ordovician rocks are dated as Middle Ordovician on the basis of graptolite and shelly faunas within the anticlinorium's southern end. Both were deformed during Taconian and Acadian orogenies; the Cambrian (?) was deformed previously during a tectonic event before deposition of Middle Ordovician sediments. Comparison of effects of three periods of deformation indicates the earliest was most penetrative and Taconian the least intense. These relations and evidence of pre-Middle Ordovician deformation in Maine, Vermont, and Quebec reported by others indicate an event (or events), in this part of the Appalachians, in Late Cambrian or Early Ordovician, and before the Taconian orogeny. — *from* Author's abstract

08343 **Haller, John.** Tectonics and neotectonics in East Greenland — Review bearing on the drift concept, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 852-858, illus., 1969.

The misfit of two triangulation nets in East Greenland established in 1870 and 1907 was a stimulus to Wegener's west-drift concept. An analysis of the regional structure of East Greenland shows intermittent tensional tectonics in the late development of the Caledonian architecture and two distinct periods of crustal widening along linear belts in the Late Jurassic and the Paleogene. Neogene and postglacial tensional structures are recorded in Iceland. The amount of crustal widening, however, is inconsiderable in comparison to postulates by advocates of the drift concept. — Author's abstract

00619 **Hamel, James V.** The Pima mine slide, Pima County, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 335, 1970.

Hamil, M. *See* Slaughter, M. 00616

Hamilton, Michael M. *See* Benham, Steven R. 00672

08191 **Hamm, W. Dow.** A challenge to the oil finder of the future, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 11-14, 1969.

Although industry is presently spending most of its capital in offshore areas in the search for oil, it is likely that many stratigraphic traps in older districts remain to be found; it is in this area that unconventional methods may make a major contribution. A continuing exploratory effort is the best assurance of success. — MCM

08377 **Han, Jerry; Calvin, Melvin.** Hydrocarbon distribution of algae and bacteria, and microbiological activity in sediments: Natl. Acad. Sci. Proc., v. 64, no. 2, p. 436-443, illus., tables, 1969.

The chemical taxonomic relationship of microorganisms has been studied through the hydrocarbon fraction of their chemical constituents. The diagenesis and biological transformations of some hydrocarbons in sediments is suggested, as a result of this information. — Authors' abstract

00970 **Hansen, Robert J.** (editor). Seismic design for nuclear power plants: Cambridge, Mass., M.I.T. Press, 489 p., illus., tables, 1970.

This book contains 15 papers on earthquake engineering design for nuclear power plants presented at a seminar held at Massachusetts Institute of Technology, Cambridge, Mass., in 1969. Papers pertinent to geologic problems are cited separately. — BFG

08199 **Harbaugh, John W.; Bonham-Carter, Graeme.** Use of computer constructed models for reconstruction of sedimentary environments, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 197-203, illus., 1969.

Dynamic systems concepts are applied to a simple dynamic mathematical model of a sedimentary basin; as defined, the system provides for two exogenous inputs: sediment from outside the system, and depth to base level or wave base. Inside the artificially bounded system the sediment is transported and the sediment sizes are fractionated according to depth, and, in turn, the water depth modified; the sedimentary basin is presumed not to subside. This set of specifications is transformed into a simple computer model which represents a two-dimensional vertical slice through a sedimentary basin; subsidence can be adjusted so that it occurs continously or periodically. Although the examples are hypothetical, they bear on some major problems of stratigraphy and sedimentation and provide alternative ways of looking at old problems and raising new questions. — MCM

08223 **Harkins, Kenneth L.; Baugher, J. W., 3d.** Geological significance of abnormal formation pressures: Jour. Petroleum Technology, v. 21, August, p. 961-966, illus., 1969.

The significance of distribution of abnormal pressure in the Bigenerina A [of the Gulf of Mexico basin area off Louisiana] is its persistent relation to mappable geologic characteristics: regional correlation with low sand content; confinement to the continental slope; its rise stratigraphically through the section in a basinward direction; and its exclusion of the major part of the oil and gas reserves. Locally these relationships may be modified by changes in rate and type of sedimentation, by normal faulting, growth faulting, uplift, and by the occurrence of piercement salt domes. — *from* Authors' conclusions

08316 **Harland, W. B.** Fleur de Lys "tilloid", *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 234-235, 1969.

A close analogy is suggested between the Fleur de Lys Group of Newfoundland and the Harkerbreen Group of Spitsbergen. Comparison of these with rocks of Great Britain suggest analogy with the Moine, rather than Dalradian. To demonstrate the possible relation between these three areas, the characteristics of the Fleur de Lys psephite, which has characteristics of a metatilloid, are discussed and an intermediate period of glaciation between the Varangian and Huronian glaciations is postulated. The Gnejssö tillite of eastern Greenland and the Harkerbreen "tilloid" of Spitsbergen may be of similar age. — VSN

08342 **Harland, W. B.** Contribution of Spitsbergen to understanding of tectonic evolution of North Atlantic region, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 817-851, illus., tables, 1969.

The tectonic evolution of Spitsbergen contributes to understanding of the North Atlantic region. Hecla Hoek rocks, late Precambrian, Cambrian, and Canadian in age, were an important part of the North Atlantic geosyncline and formed the basis for the Caledonides and the Appalachians. Periods of orogenies, intrusions, faulting, and the like are related to other areas in the North Atlantic. The Spitsbergen fracture zone involving dextral strike slip made possible the opening of the North Atlantic-Arctic Ocean. The mid-oceanic ridge approached the Spitsbergen edge of Barents Shelf and the underlying hotter mantle is believed to have caused the later Cenozoic uplift of Spitsbergen. It is suggested that the whole history of Spitsbergen is part of a North Atlantic tectonic cycle. — VSN

00850 **Harrington, J. W.** Reply [to a discussion by S. J. Gould, 1970 of papers by Harrington, 1967, 1969]: Am. Jour. Sci., v. 268, no. 2, p. 189-191, 1970.

The use of biblical references in identifying the recognition of geological thoughts by the ancients is a valid interpretation, contrary to Gould's objections (ibid., p. 187-189). No line of descent of these thoughts to the present is or was intended but rather only the recognition that the ancients were aware of geological processes. — HRC

08195 **Harrington, John W.** Unconventional uses of conventional data in the search for gas and oil, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 73-86, illus., 1969.

Conventional geologic data are used to explain why the Southeastern Georgia Embayment may be a vast untested petroliferous province; this thesis is developed in three steps: the volume of untested marine sediments justifies exploration, these sediments contain forms and structures capable of trapping oil and gas, and oil and gas are present in abundance sufficient to justify the search. The chain of inference begins with the turbidites spread across the Atlantic abyssal plains; flows that must form as unconsolidated sediments are jarred from the continental shelf by earthquakes. Experiments demonstrate the difficulty of liquifying sediment slurries without reduction of internal friction by release of gases dissolved in the water; entrapment of similar gases and oils form the exploration targets. Geologic-information parameters are spatial, material, chronologic, and genetic; conventional use is restricted to the first two. — *from* Author's abstract

00710 **Harris, Leonard D.** The Cross Mountain wrench fault — A major structural element of the southeastern United States (?) [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 214, 1970.

Harrison, C. G. A. *See* Ball, M. M. 00947

Harrison, Christopher G. A. *See* Emiliani, Cesare. 00813

Harriss, Robert C. *See* Brunskill, Gregg J. 08267

Hart, S. R. *See* Philpotts, John A. 08201

08217 **Hartshorne, N. H.; Stuart, A.** Practical optical crystallography (2d edition): New York, American Elsevier Publishing Co., 326 p., illus., 1969; originally published 1964.

This edition corrects some misprints and minor errors of the first edition, clarifies the treatment in a number of places, and updates references and descriptions of apparatus. Chapter headings are: morphology of crystals; optical properties of crystals; polarising microscope; microscopic examination of crystals (orthoscopic and conoscopic observations); stereographic projection; preparation, mounting and manipulation of material; and determining optical crystallographic properties (some practical examples). Appendices contain: books recommended for further reading, tables and collection of optical crystallographic data, sources of certain materials mentioned in the text, and some major manufacturers and suppliers of polarising microscopes. An index and a nomogram for determination of refractive indices are included. — MCM

00570 **Hatcher, Robert D., Jr.** Stratigraphy of the Brevard Zone and Poor Mountain area, northwestern South Carolina: Geol. Soc. America Bull., v. 81, no. 3, p. 933-939, illus., 1970.

The low rank retrogressively metamorphosed rocks of the Brevard zone on the northwest, the Henderson Gneiss in the middle, and the Poor Mountain sequence on the southeast form a highly sheared synclinorium overturned to the northwest. It is proposed that the rocks of the Brevard zone and the Poor Mountain sequence were originally different sedimentary facies of the same age, and that the overlying Henderson Gneiss represents later sediments deposited in the same basin. The Brevard and Henderson assemblages extend along the regional strike northeastward into North Carolina, and they and the Poor Mountain sequence occur to the southwest in Georgia. A late Precambrian-Early Cambrian age is suggested for these rocks. — WHN

00711 **Hatcher, Robert D., Jr.** Stratigraphic controls and thrusting along the Brevard zone [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 214-215, 1970.

00567 **Hatfield, Craig B.; Camp, Mark J.** Mass extinctions correlated with periodic galactic events: Geol. Soc. America Bull., v. 81, no. 3, p. 911-914, 1970.

Periodicity of mass extinctions in Earth history is correlated with the periodicity of the Sun's orbit about the galactic center and its movements perpendicular to the galactic plane. Periodically increased doses of cosmic radiation related to the Sun's position in the galaxy are suggested as a cause of recorded mass extinctions. — Authors' abstract

Haug, P. *See* Simoneit, B. R. 00943

Haughton, David R. *See* Evans, Bernard W. 08277

Haury, E. W. *See* Bucha, V. 00952

Hay, William W. *See* Boudreaux, Joseph E. 08388

Haynes, C. Vance. *See* Meighan, Clement W. 00980

Heath, Stanley A. *See* Kesler, Stephen E. 00901

08210 **Hedberg, Hollis D.** The influence of Torbern Bergman (1735-1784) on stratigraphy — A résumé: Stockholm Contr. Geology, v. 20, p. 19-47, 1969; *summary in* Toward a history of geology (C. J. Schneer, editor) — New Hampshire Inter-Disciplinary Conf. History of Geology, 1967, Proc.: Cambridge, Mass., and London, M.I.T. Press, p. 186-191, 1969.

Born in Sweden, this student of Linnaeus worked in five sciences, but attained greatest fame as a chemist and mineralogist; his contributions to stratigraphic geology are surprisingly little known. His Physisk Beskrifning (Physical description of the

Earth, 1766), translated into Danish, German, and Russian, was widely read; no English translation was ever published. Werner's famous stratigraphic classification was drawn in large part from Bergman, the "sharp-minded idol of his colleagues." His review and appraisal of the status of stratigraphic knowledge and thought when geology was emerging were keen. From study of rock layering, he concluded that most strata were water laid, and recognized four major classes by age and origin: Uråldrige, the oldest crystalline cores; Flolägrige, bedded rocks; Holvräkte, swept into very shallow water bodies; and Vulkaner, pyroclastic deposits. He related the biblical deluge to great changes in the earth. — GDC

Hedge, Carl E. *See* Peterman, Zell E. 00956

00539 **Heigold, Paul Clay.** Theoretical analysis of regional groundwater flow in the Havana region, Illinois [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3261B-3262B, 1970.

Heirtzler, James R. *See* Grim, Muriel S. 00577

00620 **Helgerson, R. N.; Mowatt, T. C.** Mineralogic relationships in the Scenic Member of the Brule Formation (Oligocene), South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 335-336, 1970.

Helmstaedt, Herwart. *See* Brown, Richard L. 08337

Helwig, James. *See* Horne, Gregory S. 08318

08319 **Helwig, James.** Redefinition of Exploits Group, lower Paleozoic, northeast Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 408-413, illus., 1969.

The eugeosynclinal Exploits Group (Exploits Series of Heyl, 1935, 1936) of northeast Newfoundland is redefined on the basis of new mapping and is assigned a pre-Llanvirnian to early Llandoverian age. The group is subdivided into five new formations and one old, plus one unnamed argillite unit: from base to top, the Tea Arm Volcanics, Saunders Cove Formation, New Bay Formation, Lawrence Head Volcanics, Lawrence Harbour Shale (old name), unnamed argillite unit, and Point Leamington Graywacke. Intertonguing relations show that older Exploits Group strata are equivalent to the Wild Bight Group west of the Bay of Exploits. Lushs Bight Group strata north of the Lukes Arm fault are interpreted to have time and lithostratigraphic equivalents in the older Exploits Group rocks. The name "Boones Point Complex" is proposed for a mylonitized lithic band which lies within and adjacent to the Lukes Arm fault zone. — Author's abstract

08323 **Helwig, James; Sarpi, Ernesto.** Plutonic-pebble conglomerates, New World Island, Newfoundland, and history of eugeosynclines, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 443-466, illus., tables, 1969.

Ordovician and Silurian conglomerate bodies in the northern Appalachian eugeosynclinal belt, exposed in three tectonic slices on New World Island in eastern Notre Dame Bay, are distinctive in being polymictic with many clasts of acidic plutonic rocks. Sedimentary structures indicate that many conglomerate beds are fluxoturbidites, particularly in the northern slice adjoining Lukes Arm fault; they are probably derived from north of the fault. Dominant igneous clasts are dacite porphyry, basaltic rocks, andesite, and tonalite. Comparison with other eugeosynclinal plutonic-pebble conglomerate shows that plutonic pebbles first appear in the flysch stage of eugeosynclinal development. The tonalite character of oldest granitic plutons here and elsewhere suggests a simatic or semi-simatic crust as the eugeosynclinal basement. In other eugeosynclinal belts, plutonic pebbles were clearly derived from sialic basement. — VSN

08312 **Henningsmoen, Gunnar.** Short account of Cambrian and Tremadocian of Acado-Baltic province, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 110-114, 1969.

The Cambrian and Tremadocian sequences of the Acado-Baltic province have remarkable similarities on both sides of the North Atlantic, both faunally and lithologically. Stratigraphic breaks seem to be present at about the same levels — at the junctions of (1) the Lower and Middle Cambrian; (2) the Middle and Upper Cambrian; (3) the *Olenus* and *Parabolina* zones within the Upper Cambrian; and (4) the Upper Cambrian and Tremadocian. However, a section through the Upper Cambrian-Tremadocian contact on Navy Island, St. John, New Brunswick, shows at the most a small faunal gap. The Cambrian and Tremadocian trilobite faunas in the Acado-Baltic province are referred to as the "Ellipsocephalid" (Lower Cambrian), "Paradoxidid" (Middle Cambrian), "Olenid" (Upper Cambrian), and "Ceratopygid" (Tremadocian) faunas. More work is needed on their paleoecology in order to evaluate fully their similarity on both sides of the North Atlantic. — Author's abstract

Henrichs, Donald F. *See* Thiruvathukal, John V. 00558

Henriksen, N. *See* Allaart, J. H. 08419

Henry, Vernon J. *See* Levy, John S. 00735

Henry, Vernon J., Jr. *See* Logan, Thomas F., Jr. 00736

Heron, S. Duncan. *See* Jorgeson, Eric. 00978

00712 **Herrick, Stephen M.** New data regarding the Okefenokee Swamp in southeastern Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 215, 1970.

08211 **Hess, Paul C.** The metamorphic paragenesis of cordierite in pelitic rocks: Contr. Mineralogy and Petrology, v. 24, no. 3, p. 19107, illus., tables, 1969.

The most useful assemblages in metapelitic rocks, for estimating pressures and temperatures are staurolite-cordierite, cordierite-biotite-Al_2SiO_5 and cordierite-hypersthene. Cordierite is stable with kyanite, sillimanite, or andalusite. At high pressures cordierite is Mg-rich. Cordierite is stable at less than 500°C but does not commonly appear in metapelitic rocks until the garnet-chlorite, chlorite-staurolite or chlorite-Al_2SiO_5 tie-lines are broken. At high metamorphic grades, the assemblage garnet-hypersthene-cordierite indicates relatively low pressures, and the assemblage hypersthene-cordierite-sillimanite relatively high pressures. The absence of cordierite is of little use in characterizing a metamorphic facies unless all alternate mineral assemblages can be shown to be more stable. — *from* Author's abstract

00713 **Hester, Norman C.** Weathering effects on the mineralogy of Upper Cretaceous sands in Alabama and Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 215-216, 1970.

08416 **Heyl, George R.** Tectonic pattern of major structural features in north-central Newfoundland, Canada [summ.], *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 792, 1969.

Heymann, Dieter. *See* Anders, Edward. 00969

Hickcox, Alice E. *See* Clark, H. C. 00881

00714 **Higgins, Michael W.; Smith, Charles W.; Zietz, Isidore.** New aeroradioactivity map of the Georgia Nuclear Laboratory area [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 216, 1970.

Hill, D. M. *See* Cloud, W. K. 00858

00809 **Hill, Robin E. T.; Boettcher, A. L.** Water in the Earth's mantle — Melting curves of basalt-water and basalt-water-carbon dioxide: Science, v. 167, no. 3920, p. 980-982, illus., 1970.

At depths below about 45 kilometers in the Earth, the presence of high proportions of carbon dioxide does not significantly affect the temperature of the beginning of melting of basalt-water compositions. Water must be present only in trace amounts in the solid part of the silicate mantle if it contains appreciable proportions of basaltic composition. — Authors' abstract

00525 **Hilpman, Paul Lorenz.** Devonian rocks in Kansas and their epeirogenic significance [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3241B, 1970.

08309 **Hird, J. M.** Control of artesian groundwater in strip mining phosphate ores in eastern North Carolina [abs.]: Mining Eng., v. 21, no. 12, p. 55, 1969.

Ho, C. *See* Prior, D. B. 00814

00526 **Hodgson, Christopher John.** Monteregian dike rocks [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3241B, 1970.

Hofstra, W. E. *See* Jenkins, C. T. 00859

00497 **Holman, J. Alan.** A small Pleistocene herpetofauna from Tamaulipas: Florida Acad. Sci. Quart. Jour., v. 32, no. 2, p. 153-158, 1969 [1970].

Amphibians and reptiles are recorded from a fauna of small vertebrate bones, probably of very late Pleistocene age in a travertine ledge in Cueva de Abra, a cave in southern Tamaulipas, Mexico. The fauna, which also contains mammals and birds, was probably derived from barn-owl pellets. Amphibia are: 0*Rhinophrynus dorsalis*, *Rana pipiens*, *Leptodactylus* cf. *labialis*, *Syrrhophus* cf. *campi*; reptiles are *Sceloporus* cf. *variabilis*, *Cnemidophorus gularis*, undetermined species of *Sceloporus*, *Lepidophyma*, and a colubrine snake; complete descriptions must await collection of more material. None of the fossils definitely represent extinct species nor occurrences unexpected in the area today, but the *Lepidophyma* most closely resembles a living species with northern limits in southern Veracruz. — VMJ

08289 **Holman, J. Alan.** Pleistocene amphibians from a cave in Edwards County, Texas: Texas Jour. Sci., v. 21, no. 1, p. 63-67, table, 1969.

Late Pleistocene faunas from caves of the Edwards Plateau are strategically located to detect rather subtle changes of animal distribution taking place between late Pleistocene and Holocene. Recently a large and interesting late Pleistocene fauna was collected from Schulze Cave, near Rock Springs. The seven amphibians in this annotated list were taken from two layers of clay matrix containing limestone fragments. Estimated age is 11,000-8,000 B.P. All species listed occur on the Plateau today; the evolution of some is traced. — ESL

00899 **Holmes, Charles W.** Trace elements in the Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 286, 1970.

00715 **Holmes, Robert F.** Thematic mapping with 1:50,000 scale side-looking radar (SLR) [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 216-217, 1970.

08276 **Holter, M. E.** The Middle Devonian Prairie Evaporite of Saskatchewan: Saskatchewan Dept. Mineral Resources Rept. 123, 134 p., illus., tables, 1969.

The history of nomenclature of the Middle Devonian is reviewed, and stratigraphy of beds overlying and underlying the Prairie Evaporite is described. Detailed stratigraphy of the Prairie Evaporite includes the Esterhazy, Belle Plaine, and Patience Lake Members, and interbeds. Minerals described include halite, sylvite, carnallite, insolubles, and anhydrite and dolomite; their relationships and distribution are discussed. The geochemistry, paleogeography, and sedimentation of the evaporite

are described, and two hypotheses for its genesis presented. Evidence is given for salt solutioning, its age, and mechanism. Potash is the principal economic product. Well data and lithologic core descriptions of type sections form an addendum. Several cross sections are included, and isopach, mineral percent, and economic potential maps, accompany the report. — ESL

08368 **Hood, Peter.** Trends and developments in 1968: Canadian Mining Jour., v. 90, no. 2, p. 157-180, illus., 1969.

Mineral exploration activity in Canada in 1968 appears to have continued the upward trend evident in the past several years; most active areas are listed. Airborne geophysical instrumentation is described for magnetic, electromagnetic, radiometric, and remote sensing systems, ground geophysical instrumentation for electrical, magnetic, radioactivity, seismic surveying systems. Geophysical research includes electrical, gravity, and magnetic; applications of all of these are discussed. The roles of geochemistry, geological exploration, and drilling and drill-hole geophysics are described. — ESL

08363 **Hope, R. C.; Patterson, O. F., 3d.** A distribution study of the estherian branchiopod *Cyzicus* in the North Carolina Triassic [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 85, no. 4, p. 123, 1969.

08411 **Hope, R. C.; Patterson, O. F., 3d.** Triassic flora from the Deep River basin, North Carolina: North Carolina Div. Mineral Resources Spec. Pub. 2, 22 p., illus., 1969.

New records for late Triassic plant distribution are provided by a deposit of plants in a light-tan to reddish-brown siltstone about 400 feet above the base of the Pekin Formation. The locality is the Boren Clay Products clay pit one and one-half miles northwest of Gulf, Chatham County, North Carolina. Almost all the fossils are compressions. Among the most common fossils found are *Neocalamites virginiensis* (Fontaine) Berry, *Otozamites powelli* (Fontaine) Berry, *Lonchopteris virginiensis* Fontaine, *Cladophlebis microphylla* Fontaine, and *Phlebopteris smithii* (Daugherty) Arnold. This material supports paleontological correlation of the Pekin Formation with the Monitor Butte Member of the Chinle Formation of Arizona. — Authors' abstract

00584 **Horai, Ki-iti; Simmons, Gene.** An empirical relationship between thermal conductivity and Debye temperature for silicates: Jour. Geophys. Research, v. 75, no. 5, p. 978-982, illus., tables, 1970.

An empirical relationship between thermal conductivity K and Debye temperature θ is suggested from data on thermal conductivity and P- and S-wave velocities for 14 silicate minerals. The relationship $\theta = (25.6 \pm 3.0)K + (385 \pm 28)$, where θ is in °K and K in mcal per cm sec °C, seems to be valid for the silicate minerals that obey the relationship of the wave velocity, the density, and the mean atomic weight (Birch's law) and the conductivity-density-mean atomic weight relationship. The empirical relationship provides a way of estimating lattice thermal conductivity in the interior of the earth from seismic data. — Author's abstract

Hornal, Robert W. *See* Spector, Allan. 00967

08371 · **Hornbrook, E. H. W.** The development and use of biogeochemical prospecting methods for metallic mineral deposits, *in* Guidelines to prospecting — A symposium: Canadian Mining Jour., v. 90, no. 4, p. 107-109, illus., 1969.

Some misconceptions about this prospecting method are clarified, and some general approaches outlined. Geobotanical prospecting is a separate method involving visual observation, tabulation, and study of plant cover types, while biogeochemistry employs chemical analysis of plants. Guidelines for appraisal of critical features of an area are provided, operational procedures outlined, and potential applications discussed. — ESL

08318 **Horne, Gregory S.; Helwig, James.** Ordovician stratigraphy of Notre Dame Bay, Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf.,

Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 388-407, illus., 1969.

The Ordovician stratigraphy south of the Lukes Arm fault zone, trending generally W-E to NE across the Notre Dame Bay region, is discussed for the New World Island, New Bay, and Badger Bay areas. Ordovician rocks to the north of the fault zone, termed the "Lush Bight terrane", are predominantly volcanic, but include minor sedimentary successions. Oldest exposed rock in the sequence south of the fault is limestone of Tremadocian age, followed by Llanvirnian-Llandeilan volcanic rocks, Llandoverian conglomerate, and Caradocian argillites. Faunules permit correlations between areas of exposure. Early Ordovician history is dominated by volcanism which continued through medial Ordovician in the southwest and also north of Lukes Arm fault zone. Elsewhere, medial Ordovician was characterized by clastic deposition in a deeply subsiding trough. Late Ordovician south of the fault was marked by the synorogenic phase of flysch deposition. — VSN

00716 **Horne, John C.; Ferm, John C.** Facies relationships of the Mississippian-Pennsylvanian contact in northeastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 217, 1970.

Horodyski, R. J. *See* Coombs, D. S. 00848

08241 **Hervitz, Leo.** Hydrocarbon geochemical prospecting after thirty years, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 205-218, illus., 1969.

During the thirty years since hydrocarbon geochemical prospecting was introduced in the United States, improvements in methods of extracting absorbed hydrocarbons from soils, as well as in techniques for detection and analysis, have been made. Experimental data show that anomalies can be repeated by resampling areas years after the original survey; however, as an oil deposit is produced, the hydrocarbon anomaly becomes weaker and tends to disappear. Although the basic 'halo' pattern continues to be observed, usually in association with large petroleum accumulations, other significant hydrocarbon-distribution patterns have also been recognized. The hydrocarbon technique can be of considerable help in evaluating flanks of domal structures and encouraging drilling 'off the top' when favorable indications are obtained. A case history is presented in which a hydrocarbon survey predicted an accumulation on the flanks of a piercement-type dome. — *from* Author's abstract

00657 **Hörz, Friedrich.** Static and dynamic origin of kink bands in micas: Jour. Geophys. Research, v. 75, no. 5, p. 965-977, illus., tables, 1970.

The geometry of kink bands in biotite was investigated on materials deformed by regional metamorphism, meteorite impact, nuclear explosion, and static and dynamic laboratory experiments. The absolute values of the kink angles δ and ϵ vary from 38° to 87° for statically deformed rocks and from 37° to 89° for shocked rocks. The asymmetry factor $\delta - \epsilon$ may be used to demonstrate that generally shock-induced kinking is more asymmetric than kinking produced statically. The angle of external rotation (ω) varies from 14° to 86° in the statically deformed rocks and from 16° to 125° in the shocked samples. Shocked biotites tend to be more intensely kinked, which results in smaller kink bandwidths than occur in their static counterparts. High stress and strain rates are believed to be responsible for these differences. These relations in kink band geometry can be useful in differentiating shock-induced kinks from kinks produced under static conditions. — *from* Author's abstract

00717 **Howe, Herbert J.** American Upper and Middle Ordovician brachiopods [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 217-218, 1970.

00718 **Hoyt, John H.** Littoral surge channels, Cabretta Island, Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 218, 1970.

00719 **Hrabar, S. V.; Potter, Paul Edwin.** Cross-bedding in the Tanglewood Limestone Member of the Lexington Limestone (Ordovician), central Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 218-219, 1970.

Hu, Tse-Chuang. *See* Best, David M. 00675

00720 **Huber, William G.** Karst topography near Claremont, Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 219, 1970.

00498 **Huff, Lyman C.** A geochemical study of alluvium-covered copper deposits in Pima County, Arizona, *with a section on* Analytical methods, *by* A. P. Marranzino and H. M. Nakagawa: U. S. Geol. Survey Bull. 1312-C, p. C1-C31, illus., tables, 1970.

Supergene dispersion of copper and molybdenum was studied in the Pima district where several ore deposits are covered by alluvium. The soil and surface alluvium here contain low and insignificant concentrations of the ore metals. Of greater interest are anomalous concentrations of copper (up to 4,000 ppm) in carbonate-cemented alluvium just above bed rock and anomalous concentrations of molybdenum in ground water (up to 250 ppb) and in plants (up to 220 ppm in ash). Dispersion of molybdenum in ground water and plants can be traced to points 8 miles from ore deposits here and might be a useful guide in the search for other deposits concealed beneath alluvium. — LCH

Huffman, M. E. *See* Cloud, W. K. 00858

00721 **Huffman, Samuel F.; Anderson, Garry G.; Orosco, Cesar A.; Eslinger, Eric V.** A carbonate sand bar near Bahia Honda Key, Florida [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 219-220, 1970.

00621 **Hughes, Gordon J.** Stratigraphy and structure in the Henderson-Willow Creek igneous belt, Granite County, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 336, 1970.

00722 **Humphrey, Ronald; Radcliffe, Dennis.** The petrology of the Siloam Granite, Greene County, Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 220, 1970.

00723 **Hunt, Graham.** Igneous rocks of Elliott County, Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 220, 1970.

00788 **Hunt, Graham; Blackburn, W. H.** A study of the effects of regional metamorphism on the equilibration of calciferous amphibole from the Irishman Creek sill, British Columbia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 221, 1970.

Hunter, Ralph E. *See* Dickinson, Kendell A. 00888

Hutchison, T. S. *See* VanNest, J. P. 08380

00661 **Ikola, Rodney J.** Simple Bouguer gravity map of Minnesota — Two Harbors sheet: Minnesota Geol. Survey Misc. Map M-9, scale 1:250,000, 1970.

08269 **Iovino, A. J.; Bradley, W. H.** The role of larval Chironomidae in the production of lacustrine copropel in Mud Lake, Marion County, Florida: Limnology and Oceanography, v. 14, no. 6, p. 898-905, illus., table, 1969.

Mud Lake is a shallow (45 cm) alkaline (pH 7.7-10.2), brown-water lake about 180 ha in area. Its organic sediment seems to be a modern analog of the lacustrine algal oozes that were precursors of the Eocene Green River oil shales. The Mud Lake ooze, about 1 m thick, consists of minute fecal pellets produced mainly by a small population of chironomid midge larvae; the pellets consist almost entirely of living blue-green algae and their partly digested remains. Midge larvae in the laboratory produced coherent and durable pellets only when they were fed blue-green algae (pellets from green algae disintegrated); in Mud Lake, larvae apparently graze on the

live blue-green algae, which grow only on or in the pellets. Minute pellets and numerous remains of midge larvae have been found in some Green River oil shale beds. — VMJ

00656 **Irving, E.; Robertson, W. A.** Reply [to comments by J. Francheteau and J. G. Sclater (1970) on "Test for polar wandering and some possible implications" (1969): Jour. Geophys. Research, v. 75, no. 5, p. 1027, 1970.

In the plate tectonics advocated by Francheteau and Sclater (ibid. p. 1023-1027) the lithosphere plates are allowed to move in an unrestricted way. Under an alternative version, in which the plates do not move indiscriminately with respect to the Earth beneath because the motions of which they are a part are driven by forces coming from the deep interior, comparisons of the type made (ibid., v. 74, no. 4, p. 1026-1036, 1969) are possible. — DBV

00724 **Isphording, Wayne C.** Origin of the post-Oligocene sediments of the Florida platform [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 221, 1970.

00622 **Izett, G. A.; Wilcox, Ray E.; Powers, H. A.; Desborough, G. A.** Pleistocene ash beds in California, Utah, Colorado, and Nebraska related to the Bishop Tuff of California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 336-337, table, 1970.

08327 **Jackson, D. E.** Ordovician graptolite faunas in lands bordering North Atlantic and Arctic Oceans, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 504-512, illus., tables, 1969.

Sequences of Tremadocian and earliest Arenigian graptolite faunas in North America, Scandinavia, and Taimyr, U.S.S.R., are similar enough to suggest that these regions were coprovincial during that time interval. During Arenigian to Llanvirnian time, two faunal provinces became differentiated — a European Province including Britain, western Europe, North Africa, and Scandinavia, and a Pacific Province including North America and Taimyr. [Characteristics of the faunas are described.] After Llanvirnian time, the two provinces lost their separate identities because the dichograptid genera in the Pacific Province became extinct, leaving essentially cosmopolitan leptograptid and biserial diplograptid and glossograptid genera. — *from* Author's abstract

Jackson, Kern C. *See* Miller, Donald K. 00913

Jeffrey, H. G. *See* Emmett, L. F. 08392

00859 **Jenkins, C. T.; Hofstra, W. E.** Availability of water for artificial recharge, Plains Ground Water Management District, Colorado: Colorado Water Conserv. Board Ground-Water Ser. Circ. 13, 16 p., illus., tables, 1970.

The report summarizes results of a joint study by the Plains Ground Water Management District and the U. S. Geological Survey between March 1 and July 1, 1969, and presents some preliminary estimates of the availability of water for recharge. The conclusions are based largely on an experimental technique for estimating streamflow and should be considered tentative as few field data on runoff and infiltration were used. U. S. Geological Survey stream flow records from 6 stations, U. S. Weather Bureau records from 7 precipitation stations, and estimates of runoff, using a channel geometry method, are given. — *from* Author's summary

Jennings, C. W. *See* Cloud, W. K. 00858

00827 **Jeran, P. W.; Mashey, J. R.** A computer program for the stereographic analysis of coal fractures and cleats: U.S. Bur. Mines Inf. Circ. 8454, 34 p., illus., tables, 1970.

A stereonet plot of attitudes of fractures and grouping of strike directions for constructing rosette diagrams are obtained rapidly and accurately by computer. — APB

08420 **Jillson, Willard Rouse.** Discovery of a late glacio-lacustrine vertebrate fauna at Frankfort, Kentucky: Frankfort, Ky., Roberts Printing Co., 17 p., illus., 1969.

Mammal bones are recorded from a new sewer line excavation in the city of Frankfort, Ky., in a 3-5 foot thick bed of unconsolidated but compact fine gray sand, here named the Ann Street Sand, near the bottom of the 15-20 foot deep trench. The sand and overlying thick clay, both showing no evidence of previous disturbance, were deposited in a glacial lake which occupied the lower Kentucky River valley in late Wisconsinan time. The 50 bones or fragments include a human femur — the first Pleistocene record of man in Kentucky — bones of two extant cervid species and the extinct species *Aenocyon dirus, Equus complicatus, Bison antiquus, Platygonus compressus.* — VMJ

John, Edward C. *See* Smith, Wilbur H. 08248

Johnson, Henry S., Jr. *See* Jorgeson, Eric. 00978

Johnson, Robert W. *See* Dennison, John M. 00693

08225 **Johnson, Ronald D.; Nelson, Samuel J.** Subsurface and outcrop, Hudson Bay Basin, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 370-375, illus., table, 1969.

The first petroleum stratigraphic test in Hudson Bay Basin, Sogepet-Aquitaine Kaskattama Province No. 1, was drilled in 1966-67. Located in Manitoba on the southwestern coast of Hudson Bay, at lat 57°04′18.487″ and long 90°10′29.408″, the well reached a total depth of 2941 feet after drilling 2913 feet of Phanerozoic strata and 28 feet of Precambrian. Besides Ordovician and Silurian rocks, Upper? Silurian and Devonian rocks, hitherto only observed as drift and rubble in the Hudson Bay Basin, were penetrated. The most promising reservoir rock is the Middle Silurian Attawapiskat Formation, a reefal and porous unit 236 feet thick. Reconnaissance surveys, made in 1963 and 1964 of Southampton, Coats and Mansel islands in northern Hudson Bay, resulted in discovery of oil shale on Southampton Island. — *from* Authors' abstract

00791 **Johnston, Paul M.; Libbey, F. W.** Memorial to Raymond Clarence Treasher (1898-1967): Geol. Soc. America Proc. 1967, p. 277-279, 1970.

00846 **Jones, E. J. W.; Ewing, M.; Ewing J. I.; Eittreim, S. L.** Influences of Norwegian Sea overflow water on sedimentation in the northern North Atlantic and Labrador Sea: Jour. Geophys. Research, v. 75, no. 9, p. 1655-1680, illus., 1970.

Reflection profiles and hydrographic data indicate that sedimentation in parts of the northernmost Atlantic and in the Labrador basin has been governed largely by the movement of bottom water derived from the Norwegian Sea. Three areas are considered in detail: the channel separating Rockall bank from the Irish continental shelf, the sediment cover on the volcanic Faeroe-Iceland ridge, and a body of thick sediments trending NNW on part of the continental rise of southern Greenland. Sedimentation under the influence of bottom currents in the latter region, in the Rockall area, and on the Blake-Bahama outer ridge took place throughout much of Tertiary time but not in Upper Cretaceous, due to a major alteration in the circulation pattern of the North Atlantic caused by continental drift, polar wandering, and climatic deterioration. — GV

00755 **Jones, J. W.; Ghent, E. D.** Low grade metamorphic rocks of the Horsethief Creek Formation, Esplanade Range, Selkirk Mountains, British Columbia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 337, 1970.

08220 **Jones, Paul H.** Hydrodynamics of geopressure in the northern Gulf of Mexico: Jour. Petroleum Technology, v. 21, July, p. 803-810, tables, 1969.

The behaviour of water in geopressured systems of the northern Gulf of Mexico basin is non-Newtonian; hydrodynamic forces are gravity related, but the dominating

forces — such as osmosis, diagenesis, and terrestrial heat flow — are molecular. — Editor's abstract

Jones, Vaughn A., Jr. *See* Roper, William A. 08222

00978 **Jorgeson, Eric; Heron, S. Duncan; Johnson, Henry S., Jr.** The Duplin Formation in the northwest coastal plain of South Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 222, 1970.

00726 **Justus, Philip S; Thayer, Paul A.; Weigand, Peter.** Comparative geochemistry and petrology of diabase dikes in the North Carolina Triassic basins [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 223, 1970.

00623 **Kahl, Alain A.; Rutford, Robert H.** A preliminary study of the White River terraces in central South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 337-338, 1970.

08239 **Kajiwara, Y.; Krouse, H. R.; Sasaki, A.** Experimental study of sulfur isotope fractionation between coexistent sulfide minerals: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 271-277, illus., tables, 1969.

Fractionation of sulfur between synthetic sulfide mineral pairs (FeS_2-PbS, ZnS-PbS, and FeS_2-ZnS) between 150° and 630°C and up to six months of reaction time reveals that the fractionation factor among these pairs decreases with increase of temperature of synthesis, and that the enrichment of S-34 is found to be in order of FeS_2 > ZnS > PbS, similarly to natural specimens. Isotopic equilibrium seems to be attained in a comparatively short period among these sulfide phases (less than 3 months at 150°C and only a few days at 630°C). The equilibrium constants obtained are fairly close to the values predicted by theoretical considerations. — *from* Authors' abstract

Kalashnikova, I. V. *See* Magnitsky, V. A. 00660

Kallberg, Razel Wittels. *See* Brace, William F. 00870

00727 **Kane, Henry E.** Late Cenozoic geomorphology of a portion of the lower Kentucky River basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 223-224, 1970.

Kane, W. T. *See* Slaughter, M. 08360

Kaplan, I. R. *See* Kolodny, Yehoshua. 00816

Kaplan, I. R. *See* Smith, J. W. 00945

Kaplan, I. R. *See* Ben-Yaakov, S. 08268

00551 **Karklins, Olgerts L.** Restudy of type species of the Ordovician bryozoan genus *Stictoporellina:* Jour. Paleontology, v. 44, no. 1, p. 133-139, illus., tables, 1970.

Stictoporellina cribrosa (Ulrich), type species of *Stictoporellina* Nekhoroshev, is restricted to the Decorah Shale, Middle Ordovician, Minnesota. A lectotype is selected for the species, which is characterized by reticulate bifoliate zoarium with abundant mesopores; boundaries separate the zooecia and mesopores in well-laminated walls; vesicle-like interspaces are rarely developed at the beginnings of exozones. Specimens from the Middle Ordovician in the Estonian SSR that were assigned to *S. cribrosa* by Bassler in 1911 constitute a new species, *S. baltea*, which has a reticulate growth form with larger fenestrules and fewer mesopores than *S. cribrosa*, wall laminae generally continuous between zooecia or mesopores, boundaries absent or localized, vesicle-like interspaces common. — *from* Author's abstract

00728 **Karklins, Olgerts L.** Preliminary Bryozoan zonation of the Lexington Limestone (Ordovician) of Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 224, 1970.

00953 **Karp, Edwin.** Denver earthquakes [discussion of note by R. B. Simon, 1970]: Science, v. 167, no. 3924, p. 1518-1519, 1970.

Issue is taken with the statement by Simon (ibid., p. 1519) that it is unnecessary to explain the Denver earthquakes in terms of pressure induced by the introduction of waste fluid. It is suggested that her data indicate that waste fluid pressures appear to have been a necessary element in the initiation of the Denver earthquake. — GV

00801 **Kay, Marshall.** Memorial to Buford Maxwell Miller (1905-1967): Geol. Soc. America Proc. 1967, p. 241-242, portrait, 1970.

08320 **Kay, Marshall.** Silurian of northeast Newfoundland coast, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 414-424, illus., table, 1969.

Fossiliferous Silurian rocks are exposed in several areas from western White Bay to Sir Charles Hamilton Sound, northeastern Newfoundland. This article summarizes the several sequences of sedimentary rocks on New World Island and nearby islands that are recognizably lower Silurian because of their fossils. Thousands of feet of sediments were deposited unconformably on Ordovician sedimentary rocks, lavas, and fragmental volcanic rocks. The conglomerate contains abundant and large volcanic and plutonic boulders, the latter increasing in proportion upward and in size northward. They are thought to have been derived by erosion from fault blocks on the north. The sequences on the east and west are summarized only briefly. — Author's abstract

08329 **Kay, Marshall.** Ordovician correlations between North America and Europe, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 563-571, illus., 1969.

The classification of the Ordovician System in North America involves the establishment of a succession of stages based on carbonate rock units in widely scattered regions. The provincial character of faunas makes intercontinental correlation difficult. The correlation of the graptolite zones with the carbonate stages is established for a few levels; the two facies rarely are found in stratigraphic succession. The graptolite zones are generally very similar to those in Europe, and some workers apply the standard British-Scandinavian zones to North America sequences. — Author's abstract

08332 **Kay, Marshall.** Thrust sheets and gravity slides of western Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 665-669, illus., 1969.

Allochthonous sequences of Cambrian and Ordovician sedimentary, volcanic, and ultrabasic intrusive rocks are preserved in two large areas in western Newfoundland — north and south of Humber Arm on the west, and in the region of St. Anthony on the north. The Humber Arm allochthon was transported, probably by gravity slide, during the Bonnian phase of the Taconian orogeny; sedimentary rocks as young as earliest Llanvirnian (early Chazyan) are overlain unconformably by limestone of the Long Point Group containing late Chazyan (Ashbyan-Valcourian Stage) and early Bolarian (Porterfieldian Stage) faunas. The transport of these sequences occurred long before that of the Taconic allochthon of western New England and eastern New York in the Vermontian phase of the Taconian orogeny in the medial Trentonian (Denmarkian Stage). — Author's abstract

08349 **Kay, Marshall.** Continental drift in North Atlantic Ocean, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 965-973, illus., 1969.

The geologic history of the North Atlantic region is relatively well understood through Triassic time. The next phase, the beginning of the Atlantic Ocean, is less satisfactorily known. A new set of stresses caused rifting across the deformed

geosynclinal belt, perhaps with right-lateral slip that moved Newfoundland far north of the extension of the Caledonian trends of the British Isles; the North American block separated from the European. The main ocean spread through Late Jurassic and Cretaceous time — Labrador separating from Greenland in the Mesozoic and Greenland from Scandinavia and Britain in the Cenozoic. In the early Tertiary there may have been cessation of separation or reduction in the rate; spreading returned to the Mid-Atlantic Ridge system in about the Miocene, and has continued to the present. — *from* Author's summary

08354 **Kay, Marshall.** (editor). North Atlantic — Geology and continental drift — A symposium presented at the International conference on stratigraphy and structure bearing on the origin of the North Atlantic Ocean, Gander, Newfoundland, 1967: Am. Assoc. Petroleum Geologists Mem. 12, 1082 p., illus., tables, 1969.

This volume contains 65 papers which include most of the papers presented at the Gander Conference plus a few others that were prepared for the sessions. Practices followed in editing the articles in order to reconcile differences in American and British spelling, stratigraphic terminology, and definitions of the Ordovician and Silurian Systems are explained. The terms Taconian and Acadian as used in North America for deformational events and structures and the terms Caledonian, Variscan, and Hercynian as used in the British Isles are defined. Fifty-one of the papers are cited separately. — VSN

00527 **Keeler, Charles Martyn.** The relationship between the mechanical and other properties of a mountain snow cover, Alta, Utah, 1967 [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3241B, 1970.

00798 **Keen, A. Myra.** Memorial to Joseph John Graham (1909-1967): Geol. Soc. America Proc. 1967, p. 211-213, portrait, 1970.

08311 **Keen, M. J.** Continental margin of eastern Canada — A summary, *in* North Atlantic — Geology and continental drift — Internat. Conf. Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 88-89, 1969.

A selected bibliography of geologic and geophysical studies (45 entries) pertinent to the Appalachian system of the continental margin of eastern Canada is presented, and a very brief summary is given of results of Dainty et al (1966), Ewing et al (1966), Fenwick et al (1968), Keen and Loncarevic (1966), and Sheridan and Drake (1968). — VSN

Keer, Frederick R. *See* Fowler, Michael L. 00702

00900 **Kehle, Ralph O.; Reid, William M.** Interpreting stress-strain data — Constant strain rate tests [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 286-287, 1970.

08238 **Kell, Klaus.** Titanium distribution in enstatite chondrites and achondrites, and its bearing on their origin: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 243-248, illus., table, 1969.

Titanium, predominantly chalcophilic in enstatite chondrites and achondrites, occurs as a constituent of troilite, daubreelite, ferroan alabandite, niningerite, and oldhamite. Titanium is a major constituent of a new sulfide mineral, a titanium-iron sulfide with Ti > Fe, which occurs in Bustee and Khor Temiki achondrites. Because of similar bulk titanium contents, but differing troilite contents and Ti concentrations in the troilite, it is concluded that enstatite chondrites are not directly genetically related to enstatite achondrites; i.e., melting of enstatite chondrites with gravitational differentiation cannot account for the origin of enstatite achondrites. Both were formed under highly reducing conditions, however. — *from* Author's abstract

08271 **Keith, J. W.** (editor). Alberta Society of Petroleum Geologists Calgary Core Conference, 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 359-528, illus., tables, 1969.

This conference provided a series of papers concerned with fundamental geological principles of sedimentation derived from the study of well cores, which were on display for examination; nine papers and three abstracts are cited individually. Papers deal with sedimentary phenomena vital to the search for petroleum, interpretation of which can be based only on the study of cores. Core studies are from unexplored regions, as well as known Devonian and Cretaceous sands and Devonian and Mississippian carbonate sediments. Discussion includes a new exploration technique which bundles sedimentary features for environmental interpretation of facies in the light of recent sedimentation, and studies of small scale sedimentary and diagenetic features with large scale results. — GDC

00586 **Kennedy, G. C.; Vaidya, S. N.** The effect of pressure on the melting temperature of solids: Jour. Geophys. Research, v. 75, no. 5, p. 1019-1022, illus., 1970.

The melting curves of Van der Waals solids are concave to the temperature axis when temperature of melting is plotted against the volume of the melting solid. The Simon equation has been derived from the examination of the melting of helium, which belongs to this class of compounds. The melting curves of metals are linear when the temperature of melting is plotted against the volume of the melting solid; the melting curves of ionic compounds are concave toward the volume axis, and silicates apparently belong to this family of compounds. Thus the curvature in the melting curve of silicates is opposite in sign to that of Van der Waals solids, and the Simon equation derived from the study of the Van der Waals solids predicts vastly too high a melting temperature at high pressure when applied to metals and particularly to ionic compounds. — *from* Author's abstract

Kennedy, M. J. *See* Phillips, W. E. A. 08315

Kepferle, Roy C. *See* Peterson, Warren L. 00747

00901 **Kesler, Stephen E.; Heath, Stanley A.** Structural evidence for Precambrian rocks in the Xolapa complex, Guerrero, Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 287, 1970.

00624 **Kessler, L. G., 2d.** Bar development and aggradational sequences in the braided portions of the Canadian River, Hutchinson, Roberts, and Hemphill Counties, Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 338, 1970.

00729 **Kettren, Leroy P., Jr.** Igneous intrusions in Highland County, Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 224-225, 1970.

00504 **Khangarot, Agam Singh.** Relative intensity of soil weathering of Wisconsin and Illinoian-age terraces near Newark, Ohio [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 2991B, 1970.

Kharin, G. S. *See* Barash, M. S. 00830

00579 **Kier, Porter M.** Lantern support structures in the clypeasteroid echinoids: Jour. Paleontology, v. 44, no. 1, p. 98-109, illus., 1970.

Five kinds of lantern supports are found in echinoids, not two as formerly supposed. Each pyramid may be supported by: 1) a pair of interambulacral supports (cidarids); 2) two ambulacral supports (noncidarid "regulars"); 3) two ambulacral supports interradial in position (Clypeasterina clypeasteroids); 4) a single interambulacral support (non-Clypeasterina clypeasteroids); and 5) three of the pyramids (2, 3, 5) each supported by a pair of ambulacral supports, and two (1, 4) each by a pair composed of one ambulacral and one interambulacral support (oligopygoids and some, perhaps all, immature cassiduloids). — *from* Author's abstract

08296 **Kierach, George A.; Cleaves, Arthur B.** (editors). Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, 112 p., illus., tables, 1969.

Growing needs have required the engineer to utilize many sites with very adverse geologic features. Due to this and growing emphasis on contract specifications, the number of engineering projects that become involved in a legal controversy is on the increase. Ten case histories are presented here by various authors; nine are cited separately. Because of their controversial nature the Geological Society of America does not necessarily concur with the views they express. The case histories in this volume demonstrate why the question, "Who pays for the unexpected in construction," arises for a number of geological circumstances common to engineering works. — GDC

08297 **Kiersch, George A.** The geologist and legal cases — Responsibility, preparation, and the expert witness, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 1-6, 1969.

The geologist is becoming increasingly involved with court cases and the legal solution to problems and disputes in engineering practice. The most frequent circumstances that give rise to litigation involving geology, result from a few major categories such as: surface water, ground water, sedimentation-channels, mineral resources and land, public health and safety, foundations-open cuts, and underground openings. Responsibilities of technical personnel on engineering projects to the owner, contractor, public-at-large, and others concerned are complex and diverse; interrelated responsibility is a common basis for litigation. For example, who is responsible for problems which arise because of the geologic conditions, both known and unforeseen. Major guidelines are enumerated for the expert witness in preparing his testimony or appearing in court to present facts or opinion. — *from* Author's abstract

08303 **Kiersch, George A.** Pfeiffer versus General Insurance Corporation — Landslide damage to insured dwelling, Orinda, California, and relevant cases, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 81-93, illus., 1969.

This case involved a decision on landslide insurance and payment of damage due to gravity sliding to an insured dwelling on the slope of a ridge in the Berkeley Hills. The issue was inclusion of underlying foundation as well as house, a point not clarified in Court previously. Soil and colluvium up to 10 feet thick mantle the soft, fractured and saturated Orinda Formation; the 45° dip of its alternating sedimentary beds nearly parallels the surface. A combined series of geologic events, both ancient and current, created this slide. Since causes were visible and landslide foreseeable, this case could not be passed over as "an act of God." The award for repair of Pfeiffer dwelling, both house and foundation, set a precedent. — GDC

00514 **Kim, Yung Sam.** An experimental investigation of initial failure criteria for brittle materials [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3208B-3209B, 1970.

Kindle, C. H. *See* Whittington, H. B. 08331

00730 **Kissling, Don L.** Recent and Silurian circumrotary corals [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 225, 1970.

00756 **Kleinkopf, M. Dean.** Magnetic and gravity studies in the Black Hills, South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 338-339, 1970.

Kline, Judith K. *See* Urban, James B. 00576

08256 **Klohn, M. L.; Pickens, W. R.** Geology of the Felder uranium deposit, Live Oak County, Texas [abs.]: Mining Eng., v. 21, no. 12, p. 63, 1969.

00625 **Klusman, Ronald W.; Towell, David G.** Some observed systematics of calcium zonation in plagioclase of rocks from the Tobacco Root batholith, southwestern Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 339, 1970.

08376 **Knopoff, Leon; Gardner, J. K.** Homogeneous catalogs of earthquakes: Natl. Acad. Sci. Proc., v. 63, no. 4, p. 1051-1054, tables, 1969.

The usual bias in earthquake catalogs against shocks of small magnitudes can be removed by testing the randomness of the magnitudes of successive shocks. The southern California catalog, 1933-1967, is found to be unbiased in the sense of the test at magnitude 4 or above; the cutoff is improved to $M = 3$ for the subcatalog 1953-1967. — Authors' abstract

08390 **Knutilla, R. L.** Water resources of the Pine River basin, southeastern Michigan: U.S. Geol. Survey Hydrol. Inv. Atlas HA-327, scale 1:125,000 and about 1 in. to 4 mi., text, tables, 1969.

Maps of scale 1:125,000 indicate physical setting and surface water in the Pine River basin; of scale 1 in. to 4 mi., glacial geology, yields of wells in glacial drift, bedrock geology, yield of wells in bedrock, and infiltration rates. Water can be obtained almost anywhere in the basin from wells completed in glacial deposits; yields are about 10 gpm except in the western corner where they are as high as 100 gpm. Only small quantities (less than 10 gpm) are available from shale and sandstone of Devonian and Mississippian age. Water from shallow wells is hard and may require softening treatment for public use; from deeper wells, although less hard, it is generally more mineralized. — MCM

Koch, N. G. *See* Bryant, A. C. 08226

00816 **Kolodny, Yehoshua; Kaplan, I. R.** Uranium isotopes in sea-floor phosphorites: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 3-24, illus., tables, 1970.

Analyses of uranium concentration and U-234/U-238 activity ratios were performed on 40 samples of marine phosphorites, almost all of them dredged from the present sea floor. Results indicate the following: All analyzed nodules are probably older than 8×10^5 yr., and at present are being eroded rather than deposited; hence, deposition of phosphorite in the present day ocean is rather doubtful. The difference in isotopic ratios between the two oxidation states of U generally confirms previously proposed mechanisms of U isotope fractionation. Differential oxidation of U-234 is largely responsible for the measured U-234/U-238 disequilibrium ratios. A model for the evolution of uranium isotope activity ratios in different oxidation states is presented. — GV

00977 **Kosanke, Robert M.** Palynological studies of the coals of the Princess Reserve district of northeastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 225-226, 1970.

Koucky, Frank L. *See* Starmer, Robert J. 00646

Koukoui, M. *See* Colmet-Daage, F. 08358

08407 **Kown, B. T.; Ewing, B. B.** Effects of the counter-ion pairs on clay ion-exchange reactions: Soil Sci., v. 108, no. 4, p. 231-240, illus., 1969.

The ion-exchange reactions of montmorillonite from Mississippi indicate that all exchange sites of the clay mineral exhibit the same ion-exchange properties. The simple mass-action expression based on this assumption is satisfactory for all metal ion pairs except when the hydrogen ion is involved. When an ion pair includes either hydrogen or an organic cation, the affinity of the exchange for these ions decreases as more exchange sites are occupied by these ions. — JWH

00902 **Krivoy, Harold L.** Comparison between seaborne and airborne magnetic reconnaissance of the Gulf of Mexico and Caribbean [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 287-288, 1970.

00903 **Krivoy, Harold L.** A magnetic lineament in the Bay of Campeche [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 288, 1970.

Krouse, H. R. *See* Kajiwara, Y. 08239

00904 **Krutak, Paul R.** Ostracode-substrate relationships, Laguna Mandinga, Veracruz, Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 288-289, 1970.

08214 **Ku, Teh-Lung; Broecker, Wallace S.** Radiochemical studies on manganese nodules of deep-sea origin: Deep-Sea Research, v. 16, no. 6, p. 625-637, illus., tables, 1969.

Manganese nodules from ocean floors were analyzed for U, Th, Pa, and Ra. U concentrations range from 4-13 ppm, and Th, 3-150 ppm, reflecting geographic and depth dependence. Th-230 and Pa-231 in outer layers greatly exceed amounts which may be supported by uranium present. Since ratios greater than 11 are found at tops of deep-sea cores, the two species must become separated during sedimentation. Their decrease with depth allows growth rates of nodules to be determined; distribution on the surface of a nodule is not uniform, higher concentrations occurring on the upper side, suggesting that they are precipitated only on surfaces in contact with sea water. Measurements of Ra-226 reinforce the conclusion that it migrates in sedimentary deposits. For oceans as a whole, the amount of Th-230 and Pa-231 in nodule deposits is probably no more than five percent of that generated by U dissolved in the sea. — *from* Authors' abstract

00856 **Kudo, Albert M.; Weill, Daniel F.** An igneous plagioclase thermometer: Contr. Mineralogy and Petrology, v. 25, no. 1, p. 52-65, illus., tables, 1970.

Compositions of coexisting plagioclase and liquid (glass) obtained by microprobe analysis of quenched samples from equilibrium melting experiments of natural granitic rocks at water pressures of 0.5 and 1.0 kb have been used along with data from elsewhere to calibrate this geothermometer. Applications of this geothermometer to natural occurrences demonstrate it is useful in rocks ranging from basalt to rhyolite. The plagioclase geothermometer is in good general agreement with other geothermometers wherever these are applicable. Where temperatures are known from other sources it can be used to predict equilibrium compositions of plagioclase in magmas as well as to provide a rough estimate of water pressure. — *from* Authors' abstract

Kullerud, G. *See* Puchelt, H. 00821

00626 **Kume, Jack.** Choteau Creek and its relationship to Choteau aquifer in Charles Mix and Douglas Counties, southeast South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 339-340, 1970.

Lacy, Willard C. *See* Beveridge, Thomas R. 08249

00826 **Ladanyi, B.** Discussion of W. F. Brace and R. J. Martin's paper, 'A test of the law of effective stress for crystalline rocks of low porosity' [1968]: Internat. Jour. Rock Mechanics and Mining Sci., v. 7, no. 1, p. 123-124, 1970.

Experimental evidence on pore-pressure behavior of low porosity solids is scarce, and results shown in the paper [ibid., v. 5, no. 5, 1968] represent a valuable contribution to rock mechanics. Rocks tested did not show pore-pressure behavior very different from that of very dense soils. The authors' conclusion that the law of effective stress is valid only at a very slow strain rate involves a difference in definition of effective stress between the introduction and the rest of the paper. Results substantiate validity of the law according to the first definition, but the law breaks down if the second definition, neglecting strain-induced pore-pressure variation within the sample, is adopted. The second definition offers no advantages over the first, and can only cause confusion. — ESL

00544 **Lammons, James Monroe.** The palynology and paleoecology of the Pierre Shale (Campanian-Maestrichtian) of northwestern Kansas and environs [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3309B, 1970.

Landisman, M. *See* Dziewonski, A. 00780

00528 **Lane, Harold Richard.** Morrowan (Lower Pennsylvanian) conodonts from northwestern Arkansas and northeastern Oklahoma [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3242B, 1970.

Langton, J. R. *See* McCulloch, R. C. 08272

08422 **LaPorte, Leo F.** Carbonate facies of the Helderberg Group (Lower Devonian) of New York, Trip 9 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 9-1 — 9-3, 1969.

Four stops in a field trip are outlined; the geology between the stops is not discussed. The stops visit the Rondout and Manlius Formations in the Delmar quadrangle and the Manlius and Coeymans Formations in the Clarksville and Coxsackie quadrangles. Four environments of carbonate deposition are viewed: (1) tidal flat and restricted shallow subtidal, (2) open subtidal, (3) open, lower energy subtidal, and (4) open, lower energy, subtidal clastic shelf. These environments coexisted from west to east, for several tens of miles; following the regional transgression, they migrated westward across New York State. — HRC

Larson, E. E. *See* Goldstein, Myron A. 08205

00796 **Laswell, Troy J.** Memorial to Paul Heaney Dunn (1895-1967): Geol. Soc. America Proc. 1967, p. 203-205, portrait, 1970.

00955 **Laul, J. C.; Case, D. R.; Schmidt-Bleck, F.; Lipschutz, M. E.** Bismuth contents of chondrites: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 89-103, illus., tables, 1970.

A neutron activation technique has been developed for determination of the bismuth concentrations in C-, H-, L-, and LL-group chondrites. Analyses of 14 carbonaceous and 5 equilibrated ordinary chondrite samples have confirmed that Bi is a strongly-depleted element in meteorites. The mean Bi abundances in carbonaceous chondrites are 143, 71, and 37 atoms per 10^6 Si atoms for groups C1, C2, and C3, respectively. Although there are exceptions in 12 unequilibrated ordinary chondrites (UOC), the Bi contents generally decrease exponentially with increasing equilibration of the silicate phases. The Bi concentrations in the UOC correlate well with those of carbon and primordial Ar, Kr and Xe determined by others in these same meteorites. — GV

00844 **Laursen, Dan.** Profiler af udenlandske videnskabsmaend i Gronland — [Pt.] 4, William Herbert Hobbs [1864-1923]: Grönland 1970, no. 3, p. 83-84, portrait, 1970.

00731 **Lawrence, David R.** A communication system for paleoecology [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 226, 1970.

Lawrence, H. W. *See* Baltosser, R. W. 00843

00905 **LeBlanc, Rufus J., Sr.** Coastal interdeltaic sedimentation in the northwest gulf region [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 289, 1970.

08427 **Lee, G. Fred; Wilson, William.** Use of chemical composition of freshwater clamshells as indicators of paleohydrologic conditions: Ecology, v. 50, no. 6, p. 990-997, illus., table, 1969.

The Sr:Ca atomic ratio in fresh-water clam shells can be used as an indicator of paleohydrologic conditions if the shells have not undergone diagenesis and are part of a controlled chronological sequence. The Sr:Ca ratio in water of Mill Creek in Cherokee County, Iowa decreases with increasing discharge. The Sr:Ca ratios of clam shells excavated from Indian midden sites near Mill Creek and near Big Sioux River in Plymouth County, occupied about 900-1400 A.D. (according to C-14

dates), show changes in successive midden levels corresponding to the onset of the Secondary Climatic Optimum about 900 A.D., with warm rainy summers, and the change to cooler, more arid climate about 1200 A.D. Climatic changes are indicated also by changes in flora and fauna recovered chronologically from the sites. — VMJ

00854 **Leeman, William P.; Rogers, John J. W.** Late Cenozoic alkali-olivine basalts of the Basin-Range Province, USA: Contr. Mineralogy and Petrology, v. 25, no. 1, p. 1-24, illus., tables, 1970.

Basaltic andesites from the Basin-Range Province appear to be differentiates from the more primitive alkali basalts which otherwise predominate. Similarly-aged basalts from adjacent regions are predominately tholeiitic. This apparent petrologic provincialism is supported by complementary variations in heat flow, seismic velocities, crustal thickness, magnetic anomalies, and geologic setting. Alkali-olivine basalts from Japan and Australia are analogous, and it is suggested that these lavas are products of a unique environment characterized by high heat flow and a thin crust. These basalts could be produced by the partial melting (less than 20 percent) of peridotitic mantle at depths between 40 and 60 km in response to an elevated geothermal gradient. Basaltic andesites may be derived from hydrous alkali basalt magma by fractionation at depths of 30 to 40 km. — *from* Author's abstract

08361 **Leimer, H. W.; Slaughter, M.** The determination and refinement of the crystal structure of yugawaralite [with German abs.]: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 88-111, illus., tables, 1969.

Yugawaralite is monoclinic, a=6.73, b=13.96, c=10.02 A, β=111°30′, space group Pc, and Z=2 for ideal composition $CaAl_2Si_6O_{16}\ 4H_2O$. The structure is characterized by 4-membered ring groups approximately perpendicular to the C axis, by 5-membered ring groups at about 65° to either side of the ac plane, and by 8-membered ring groups forming channels parallel to a and c axes. Yugawaralite has relatively open channels in two directions, but they are so small as to limit its use as a molecular sieve. It does not have enough characteristics in common with other zeolites to place it in any of the seven defined structural groups. It is suggested that an eighth group be created to include the new linkages contained in yugawaralite. — *from* Authors' abstract

00732 **Leith, C. J.** Environmental aspects of beach processes, sediment, and erosion in the coastal region of North Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 226-227, 1970.

00906 **LeMone, David V.** Middle Canadian (Lower Ordovician) cyclic digitate algae of the José Formation, southern Franklin Mountains, El Paso County, Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 289-290, 1970.

00627 **Lessard, Robert H.** Micropaleontology and paleoecology of the Tununk Member of the Mancos Shale [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 340, 1970.

Leung, K. Y. *See* Calvo, C. 08284

00733 **Leung, Samuel S.** A vertical chemical profile of the Greenland ice sheet at Camp Century [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 227, 1970.

00734 **Leung, Samuel S.** Trace ferride content in magnetites of cores and host rocks of different geologic occurrences [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 227-228, 1970.

00961 **Levinton, Jeffrey S.; Bambach, Richard K.** Some ecological aspects of bivalve mortality patterns: Am. Jour. Sci., v. 268, no. 2, p. 97-112, illus., 1970.

A logarithmic growth model, D=s ln (T+1), where D=length, T=age, and s is a constant, is proposed as a convention for relating size and relative age in bivalve mollusks. Studies of size-frequency distributions of dead Recent and fossil bivalve mol-

lusks employing this relationship indicate that calculated survivorship curves can be correlated with ecological parameters. Shallow-water, muddy-bottom bivalve associations were studied. Calculated survivorship patterns of two infaunal proboscidial deposit-feeding nuculanids show a nearly constant probability of mortality through most of the life span. *Mulinia lateralis* has very high juvenile mortality, however, in muddy substrates. Clogging of the filtering apparatus is probably the limiting factor. — *from* Authors' abstract

00735 **Levy, John S.; Henry, Vernon J.** Seasonal variations in suspended sediment in a salt marsh estuary [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 228, 1970.

08275 **Lewand, Raymond L., Jr.** The geomorphic evolution of the Leon River system: Baylor Geol. Studies Bull. 17, 26 p., illus., 1969.

The present Leon River valley apparently conducted the discharge of the Brazos River from early Pleistocene until late Kansan time. Inherited features of the former, much larger, river remain within Leon Valley. These features are high abandoned valleys, alien soils, foreign siliceous terrace components, and underfit valley meanders. The ancestral Leon-Brazos entered the present Leon basin just north of Eastland, Texas through an abandoned valley. The Leon-Brazos system is thought to have drained an extensive part of the caprock region, since the characteristic siliceous gravels of its terraces are derived from the basal Ogallala Formation of the High Plains. A primary source for the alien siliceous terrace material is apparently the quartzitic outcrops of the South Manzano Mountains of central New Mexico. — *from* Author's abstract

Lewis, Anthony J. *See* MacDonald, Harold C. 00907

00628 **Lewis, Paul H.** Microenvironmental relationships of the Petrified Forest Member of the Chinle Formation (Triassic) in and adjacent to the Petrified Forest National Park, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 340-341, 1970.

Libbey, F. W. *See* Johnston, Paul M. 00791

00613 **Lillegraven, Jason A.** Stratigraphy, structure, and vertebrate fossils of the Oligocene Brule Formation, Slim Buttes, northwestern South Dakota: Geol. Soc. America Bull., v. 81, no. 3, p. 831-850, illus., table, 1970.

The Oligocene Brule Formation contains eight lithologic units assigned to three environmental facies (main channel, flood plain, and dry plains). Study of approximately 3500 mammalian fossils increased the former vertebrate faunal lists by 43 genera and changed the stratigraphic ranges of some individuals. The structural setting is dominated by a parallel series of faults that break the formation into a horst-graben sequence; joint sets dipping in opposite directions at about 60° from the bedding planes are also prominent. These and other features indicate that slumping and landsliding do not best explain the structure but that superficial normal faulting with some rotation of the grabens during translatory movement along low-angle, gravity-controlled detachment faults was probably the mechanism of movement. — HCW

00629 **Lindsey, David A.** Facies and paleocurrents in conglomerates of the Harebell Formation and Pinyon Conglomerate, northwestern Wyoming [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 341, table, 1970.

00832 **Linehan, Daniel.** Geological and seismological factors influencing the assessment of a seismic threat to nuclear reactors, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 69-90, illus., 1970.

The seismic activity of the central plains and the eastern United States is considered in relation to foundation sites for nuclear power plants. The magnitude of possible earthquakes originating on a given fault, and their attenuation away from it are investigated. Seven papers are cited separately. — BFG

00529 **Link, Arthur Jürgen.** Inclusions of the Half Dome Quartz Monzonite, Yosemite National Park, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3242B, 1970.

Lipschutz, M. E. *See* Laul, J. C. 00955

08322 **Lock, Brian E.** Silurian rocks of west White Bay area, Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 433-442, illus., 1969.

The lower Paleozoic section in this area is divided into two groups: the Coney Arm Group, of probable Cambrian-Ordovician age and showing two cleavages and biotite-grade regional metamorphism; and the Sops Arm Group with one cleavage and chlorite-grade metamorphism. The highest formations in the Sops Arm Group contain Silurian corals and brachiopods. The Group is divided into six formations, three of which are new (Main River, Stoney Hill, and Jacksons Arm), consisting of shallow-water sandstone and conglomerate with basic and acidic volcanic and pyroclastic rocks, including ignimbrite. Environment of deposition was one of shelf seas; the structural setting suggests that the western margin of the mobile belt was north of these outcrops. — VSN

08339 **Lock, Brian E.** Paleozoic wrench faults in Canadian Appalachians — Discussion [of paper by G. W. Webb, 1969], *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 789-790, illus., 1969.

The nature of the White Bay, Newfoundland, faults are discussed in light of Webb's suggestion (ibid., p. 754-786) that they may be part of a major system of strike-slip faults extending into Nova Scotia. Heyl (1937) has interpreted these faults as thrust faults, and Wilson (1962) as transcurrent faults similar to the Cabot fault. It is suggested here that the evidence on the faults is contradictory but that strike-slip movement seems more likely, with movement in a right-lateral sense. This is the reverse of the sense postulated by Wilson, and is a problem for those trying to correlate the Cabot and Great Glen faults. — VSN

00736 **Logan, Thomas F., Jr.; Henry, Vernon J., Jr.** Pleistocene drainage in McIntosh County, Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 229, 1970.

Lohier, G. *See* Colmet-Daage, F. 08358

Long, Leon E. *See* DeLong, Stephen E. 00887

00847 **Longacre, Susan Ann.** Trilobites of the Upper Cambrian Ptychaspid Biomere, Wilberns Formation, central Texas: Paleont. Soc. Mem. 4 (Jour. Paleontology, v. 44, no. 1, supp.), 70 p., illus., table, 1970.

Trilobites from the Morgan Creek, Point Peak, and San Saba Members comprise 89 species in 45 genera in the upper Franconian and Trempealeauan Stages. New names proposed for the four zones recognized in central Texas are: *Taenicephalus* Zone, *Idahoia* Zone, *Ellipsocephaloides* Zone (all Franconian), and the Trempealeauan *Saukia* Zone, with four subzones, terminating at the Ordovician boundary. These zones comprise the Ptychaspid Biomere, dominated by families Parabolinoididae and Ptychaspididae; Drumaspidinae and Ptychaspidinae are new subfamilies of the latter. New species are: *Conaspis leptoholcis, Idiomesus infimus, Euptychaspis frontalis, Keithiella scapane, Saukiella serotine, Prosaukia remora, Calvinella prethoparia, Westonaspis? texana.* — REG

00737 **Lowry, W. D.** Proterozoic origin of North American geosynclines [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 230, 1970.

Ludlam, Stuart D. *See* Brunskill, Gregg J. 08265

08307 **Ludlam, Stuart D.** Fayetteville Green Lake, New York — [Pt.] 3, The laminated sediments: Limnology and Oceanography, v. 14, no. 6, p. 848-857, illus., table, 1969.

The surficial sediments of Fayetteville Green Lake show laminated and unlaminated beds. Couplets of a basal pale [predominantly calcite crystals] and an overlying dark lamina, deposited annually, are true varves. Unlaminated beds are probably deposited from density currents. Varve sedimentation averages 0.07 g cm^{-2} yr^{-1} dry wt or 0.05 g cm^{-2} yr^{-1} $CaCO_3$. Turbidites account for 40 to 60 percent total sediment accumulation. — Author's abstract

08197 **Luehrmann, W. H.** Seismic profiles across the Atlantic, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 127-137, illus., 1969.

This is the commentary for a 30-minute film which is an illustrated, seismic-profile cross section of the deep ocean floor and subbottom sedimentary layering from the island of Trinidad, B.W.I., to the port of Monrovia, Liberia. The traverse, completed in 14 days, was about 5,600 km long; the film shows about two-thirds of the actual field sections. The data, which have not been processed, consist of essentially continuous seismic profile records. What is seen is the unfolding of the subsea geology, with the water surface at the top of the record, and the first major event the sea floor, followed by numerous reflector events which detail the stratigraphic sequence below the sea floor. — MCM

Lulstro, Antonio O. *See* Bischoff, James L. 00981

00581 **Lundelius, Ernest L.; Stevens, Margaret S.** *Equus francisci* Hay, a small stilt-legged horse, middle Pleistocene of Texas: Jour. Paleontology, v. 44, no. 1, p. 148-153, illus., table, 1970.

Metapodials of the type specimen of *Equus francisci* Hay, 1915, from the Lissie Formation, Wharton County, Tex., have been re-studied. Additional preparation showed that the metatarsal is 20 percent longer than originally reported, indicating that the species is a small, stilt-legged horse. *Equus francisci* is distinct from *E. conversidens* Owen, 1869; ?*E. quinni* Slaughter et al., 1962, from Texas, and *Onager zoyatalis* Mooser, 1958, from Mexico, are considered junior synonyms of *E. francisci*. — *from* Author's abstract

00738 **Lurie, Patricia L.** A study of the surface textures of sand grains from the Atlantic continental margin by use of the transmission electron microscope [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 230-231, 1970.

08365 **Lurie, Patricia L.** An application of the electron microscope to quartz surface texture studies in North Carolina rise sediments [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 85, no. 4, p. 124, 1969.

00855 **Luth, W. C.; Querol-Sufié, F.** An alkali feldspar series: Contr. Mineralogy and Petrology, v. 25, no. 1, p. 25-40, illus., tables, 1970.

A series of alkali feldspars was crystallized from dehydrated gels at 500 bars and 800°C in the presence of an aqueous vapor phase, quartz, and corundum. The K_2O and Na_2O were analyzed in 20 samples by atomic absorption spectrophotometry, and unit cell parameters were obtained by least squares refinement of X-ray powder diffraction data. Variations in unit cell parameters as a function of composition, are expressed in polynomials. These are compared with similarly-developed data available on the sanidine-high albite series. The differences shown by this series are principally in the higher values of the *b* and *c* unit cell edges, for a given N_{or}, and consequently higher unit cell or molar volume for a given N_{or}. The differences are probably because the feldspar series is less ordered in terms of Al/Si distribution than the sanidine-high albite series. — HRC

00543 **Luyendyk, Bruce Peter.** Geological and geophysical observations in an abyssal hill area using a deeply towed instrument package [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3309B, 1970.

Luza, Kenneth V. *See* Rice, Lee R. 00639

MacDonald, H. C. *See* Wing, R. S. 00941

00907 **MacDonald, Harold C.; Lewis, Anthony J.** Mapping and landform analysis of coastal regions with radar [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 290, 1970.

08192 **MacElvain, Robert C.** Mechanics of gaseous ascension through a sedimentary column, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 15-28, illus., 1969.

No basic scientific principle has been adequate to demonstrate lateral migration of gas except by molecular diffusion of dissolved methane in either static or moving water; both of these conditions are processes of dilution which can never lead to formation of a concentration. Experiments demonstrate that mechanics of gas in the earth are controlled by the diffusion process to a very small extent and by gravitation displacement of small bubbles to a very large extent. The probability is great that concentrations of natural gas have been formed by dilution forces acting upon a much larger concentration. It is suggested that there is reason to explore for deeper reservoirs beneath stratigraphic traps, and that there are more youthful accumulations more recently formed in older rock formations. Mechanics of exceedingly small gas bubbles suggest a dynamic relation between deep subsurface accumulations and near surface macro- and micro-gas seepages. *from* Authors' conclusions

08400 **MacKenzie, W. S.** Stratigraphy of the Devonian Southesk Cairn carbonate complex and associated strata, eastern Jasper National Park, Alberta: Canada Geol. Survey Bull. 184, 77 p., illus., tables, 1969.

Easily accessible Upper Devonian carbonate outcrops in the Rocky Mountain Foothills are valuable in supplemental studies for petroleum exploration of stratigraphically equivalent producing reefs in the Alberta subsurface. On a dark biostromal carbonate and calcarenite platform in late Devonian seas, stromatoporoidal carbonates accumulated where organic growth was favorable, ever higher with deepening water. At first water depth increased so rapidly the tapering carbonates were onlapped by surrounding black euxinic shales; small peripheral bioherms were soon drowned. With change to relative crustal stability, a long second stage is indicated by a thick sequence of light colored calcareous sands on a bank grown laterally in shallow water. Marine plant and animal life played an important role by skeletal contributions, stabilizing effects of roots, and baffle action. Overlying disconformity is widespread evidence of erosion. — GDC

00660 **Magnitsky, V. A.; Kalashnikova, I. V.** Problem of phase transitions in the upper mantle and its connection with the Earth's crustal structure: Jour. Geophys. Research, v. 75, no. 5, p. 877-885, illus., 1970.

Phase transformations in the upper mantle could be considered as the cause of recent vertical crustal movements. Using data obtained in high-pressure experiments, calculations justify such an assumption. The oscillatory character of movements with periods 10^4-10^8 years is explained by the decoupling effect of an asthenosphere layer with low viscosity. — Authors' abstract

08413 **Maher, J. C.; Trollman, W. M.** Geological literature on the Cook Inlet basin and vicinity, Alaska: Juneau, Alaska, Alaska Dept. Nat. Resources, 82 p., illus. [1969?].

This compilation includes most of the geological literature on the Cook Inlet basin and adjacent highlands in southern Alaska published prior to May 1, 1969, in the fields of petroleum geology; stratigraphy; paleontology; structure; geophysics;

petroleum exploration, development, and production; and mineral-deposit geology. No attempt was made to include professional and trade-journal articles dealing primarily with mining operations in the adjacent highlands. — MCM

00508 **Majtenyi, Steven Istvan.** An application of stereo aerial photographs to the estimation of discharge properties of drainage basins [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3163B, 1970.

Mamay, Sergius H. *See* Grew, Edward S. 00954

Mangus, Marlyn. *See* Schaeffer, Bobb. 00580

Maniatis, Jessie. *See* Alberstadt, Leonard P. 00666

Mankin, Charles J. *See* Wu, Dah Cheng. 00971

08357 **Mann, John F., Jr.** Ground-water management in the Raymond Basin, California, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 61-74, illus., tables, 1969.

The Raymond Basin, northeast of Los Angeles, is an area of ground-water storage in alluvial fan deposits, flanked on the north by high mountains and on south by a semipermeable fault. Because of early urban development, made possible by intensive exploitation of local ground water, effects of withdrawals in excess of replenishment precipitated the first attempt in California to adjudicate the water rights of an entire ground-water basin. The litigation resulted in pumping being cut back to the safe yield, enforced by a Watermaster. Under continuing jurisdiction of the Court, a restudy of safe yield indicated that it had increased substantially and pumping rights were proportionately increased. After 20 years of ground-water management, it can be concluded that these pioneering efforts were effective for local water users. — *from* Author's abstract

Martin, D. F. *See* McLester, M. E. 00787

00908 **Martin, Ray G., Jr.** Structure of the continental margin, northeasternmost Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 290-291, 1970.

00958 **Marvin, Ursula B.; Wood, J. A.; Dickey, J. S., Jr.** Ca-Al rich phases in the Allende meteorite: Earth and Planetary Sci. Letters, v. 7, no. 4, p. 346-350, illus., tables, 1970.

The newly fallen Type III carbonaceous chondrite contains abundant, irregular bodies of unusual bulk chemistry: rich in Ca and Al, poor in Si. Phases identified in these bodies include spinel, hercynite, gehlenite, anorthite, nepheline, diopside, fassaite, ferroaugite, perovskite, and Ca-Al-rich glass. High temperatures and an effective mechanism of chemical fractionation were required to form these assemblages. We suggest that they may represent early, high temperature condensates from the solar nebula. — Authors' abstract

Mashey, J. R. *See* Jeran, P. W. 00827

00909 **Matalucci, Rudolph V.; Shelton, John W.; Abdel-Hady, Mohamed.** Relationship of fabric to shear failure in Vicksburg loess [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 291, 1970.

Mateker, Emil J., Jr. *See* Ehrlich, Marvin. 08299

Mathisrud, Gordon C. *See* Gilles, Albert P. 00617

08378 **Matter, Philip, 3d; Davidson, Franklin D.; Wyckoff, Ralph W. G.** The composition of fossil oyster shell proteins: Natl. Acad. Sci. Proc., v. 64, no. 3, p. 970-972, tables, 1969.

Analyses of the protein residues recovered from fossil oyster shells of ages from the Pleistocene through the Cretaceous show substantially the same amino acids as are present in modern proteins. The amount of these residues declines sharply to the Oligocene, after which it proceeds more slowly. These older proteins contain relatively less aspartic acid and glycine than do their younger counterparts. — Authors' abstract

08279 **Matthews, William H., 3d.** The story of volcanoes and earthquakes: Irvington-on-Hudson, N. Y., Harvey House, 126 p. illus., 1969.

This introductory, popular account of volcanoes and earthquakes contains chapters on: the death of two cities (Pompeii and Herculaneum); what are volcanoes?; fire and thunder from below—how volcanoes erupt; volcanic landforms; volcanoes and man; our quaking earth; effects of earthquakes; tracking down earthquakes; and seismology and man. A bibliography, a glossary, and an index are appended.—MCM

00785 **Maynard, G. Lafayette.** Crustal layer of seismic velocity 6.9 to 7.6 kilometers per second under the deep oceans: Science, v. 168, no. 3927, p. 120-121, illus., table, 1970.

Refraction measurements made in the deep ocean between the Marshall and Hawaiian Islands reveal a layer of seismic velocity 7.3 kmps between the 6.8 kmps oceanic crustal layer and the mantle. This layer, normally masked as a second arrival, is revealed by continuous air gun refraction data. The layer may be widespread in the deep oceans. — Author's abstract

Mazor, Emanuel. *See* Anders, Edward. 00969

08351 **McCartney, W. D.** Geology of Avalon Peninsula, southeast Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 115-129, illus., table, 1969.

Studies concerning the geology of the late Precambrian and early Paleozoic sedimentary, volcanic, and plutonic rocks of the Avalon Peninsula, Newfoundland as described in detail by Hutchinson, 1953, 1962; Jenness, 1963; McCartney, 1967; and Rose, 1952, are summarized. These studies and many later detailed studies were summarized previously by the author in Canada Geol. Survey Mem. 341, p. 1-3, 1967 (see Abstracts of North American Geology for October 1967). — VSN

08272 **McCulloch, R. C.; Langton, J. R.; Spivak, A.** Simulation of high relief reservoirs, Rainbow field, Alberta, Canada: Jour. Petroleum Technology, v. 21, November, p. 1399-1408, illus., tables, 1969.

Detailed studies on reefs in the Rainbow field reveal the presence of 14 lithofacies, representing six depositional environments. Steps followed in using these geological studies to map reservoir properties for use in models are listed. A comparison of three-dimensional and one-dimensional models for both natural depletion and crestal gas injection shows that for high relief reservoirs, a one-dimensional model is adequate for many reservoir engineering applications. An appendix contains descriptions of five types of reservoir facies. — ESL

McEvilly, T. V. *See* Cloud, W. K. 00858

00530 **McGowen, Joseph Hobbs.** Gum Hollow fan delta, Nueces Bay, Texas — Mode of development and sediment characteristics [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3242B-3243B, 1970.

McGregor, E. E. *See* Cattermole, J. M. 00599

00805 **McGrew, Paul O.** Memorial to Horace Davis Thomas (1905-1967): Geol. Soc. America Proc. 1967, p. 269-271, portrait, 1970.

00803 **McGuinness, C. L.** Memorial to Albert Nelson Sayre (1901-1967): Geol. Soc. America Proc. 1967, p. 253-257, portrait, 1970.

00910 **McKay, Gordon A.; Rogers, John J. W.** Ignimbrites of the Seven Springs Formation, Barrilla Mountains, U. S. A. [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 291, 1970.

08317 **McKerrow, W. S.** Silurian rocks of Ireland and a comparison with those of Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 284-288, illus., 1969.

In eastern and central Ireland, most of the Silurian is eugeosynclinal and lies with little or no break on upper Ordovician beds. However, in the west there is more variation in facies, and Silurian deposits older than C_4-C_5 age (high upper Llandoverian) are not known. In Galway and Mayo, Silurian rocks lie unconformably on older beds. The Dingle Peninsula in southwest Ireland has a shelf facies containing Wenlockian acidic volcanic rocks, but the relations with pre-Silurian beds are obscure. The ages and geographic distribution of sedimentary facies and volcanic rocks in western Ireland do not correspond in detail to those of northeastern Newfoundland, and the absence of a marked early Silurian marine transgression in Newfoundland also might suggest some degree of separation. The fact that marine species were common to both sides of the Atlantic during the Silurian does not prove close proximity. — Author's abstract

00739 **McKinney, Frank K.** Trepostomata (Phylum Ectoprocta) from the lower part of the Chickamauga Group (Middle Ordovician) of northeastern Alabama [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 231-232, 1970.

00509 **McKyes, Shirley Edward.** Yielding of a remoulded clay under stress states [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3165B, 1970.

00787 **McLester, M. E.; Martin, D. F.; Taft, W. H.** Effects of alkaline-earth metal ions on the transformation of aragonite to calcite in aqueous solution: Jour. Inorganic and Nuclear Chemistry, v. 32, no. 2, p. 391-399, illus., tables, 1970.

The transformation kinetics of aragonite, a metastable form of $CaCO_3$, to the stable form, calcite, has been measured for the heterogeneous system of solids in contact with solutions of alkaline-earth metal ions at 50°C. The kinetic data are consistent with the expression, $\ln x/(1-x) = kt$, where x is the fraction of calcite at a given time, t. Under conditions of constant pH and temperature, the rate constant k is a function of the concentration of the non-common alkaline-earth metal ion, all of which tend to inhibit the recrystallization at higher concentrations. The inhibiting concentrations (as 10^3M) are: Be, < 4.7; Mg, 56; Sr, 60; Ba, 72. These data can be correlated with the coordinating tendencies of the non-common metal ion. — Authors' abstract

08250 **McMillion, L. G.** Groundwater reclamation by selective pumping [abs.]: Mining Eng., v. 21, no. 12, p. 55, 1969.

McNeal, B. L. *See* Muhammed, Shah. 08397

McNeill, J. D. *See* Barringer, A. R. 00557

00980 **Meighan, Clement W.; Haynes, C. Vance.** The Borax Lake site revisited: Science, v. 167, no. 3922, p. 1213-1220, illus., tables, 1970.

Reanalysis of geology and artifacts gives evidence of an early man location in California. Neither the geological nor the typological evidence is inconsistent with a date of up to 12,000 years ago for the original occupation of the Borax Lake site. Obsidian dating also suggests the reasonableness of such an age. In its original occupation the site was probably a lakeside hunting camp comparable to other dry lake sites of the Great Basin and southern California; but being nearer the Pacific coast, climatic changes were less harsh so the site could be occupied by successive hunters and

gatherers down to relatively recent times. For the past 2,000 years at least, however, the drier Borax Lake basin has been less attractive for aboriginal settlements than nearby Clear Lake, which is still full of water. — DBV

Melickian, Gary E. *See* Beveridge, Thomas R. 08249

Melson, William G. *See* Switzer, George. 00563

00911 **Menzer, Fred J.; Slaughter, Bob H.** Evidence bearing on the age of Texas topography [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 292, 1970.

08403 **Merriam, Daniel F.** (editor). Computer applications in the earth sciences, an international symposium — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, 281 p., illus., tables, 1969.

This conference attempted to acquaint earth scientists with the tremendous advancements made in quantitative methods in recent years and to accent future possibilities in this overall appraisal. The symposium was sponsored by the Kansas Geological Survey, the International Association for Mathematical Geology, and the University of Kansas Extension. Fifteen of the 16 papers are cited separately. — MCM

08229 **Metherell, R. G.; Workman, L. E.** Sedimentary features of the Crossfield Member, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 444-459, illus., 1969.

This gas-producing member in the middle of the Stettler Formation of upper Devonian age averages about 100 feet in thickness in a north-south belt, 2 to 12 mi wide, extending 90 mi between Olds and Okotoks, Alberta. The Crossfield, consisting of porous dolomite between the dense anhydrite and evaporite members, forms a shallow shelf deposit with open marine sediments to the west and tidal evaporites to the east, and is divisible from the bottom upward into three zones, each with different facies types: (1) basal shallow mud and lenticular algal accumulation; (2) a dominantly stromatoporoid and gastropod bank; (3) a dominantly algal bank. It appears, from illustrated core features, that the lower zone is more or less variable in deposition, the middle zone is transgressive eastward, and the upper zone regressive westward. — GDC

00912 **Meyerhoff, A. A.** Continental drift — [Pt.] 2, High-latitude evaporite deposits and geologic history of Arctic and North Atlantic Oceans [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 292, 1970.

00808 **Meyerhoff, Howard A.** Memorial to Stephen Sargent Visher (1887-1967): Geol. Soc. America Proc. 1967, p. 283-286, portrait, 1970.

08228 **Michaelis, E. R.; Dixon, G.** Interpretation of depositional processes from sedimentary structures in the Cardium Sand, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 410-443, illus., 1969.

Sedimentary structures in the Cardium Sand of Alberta record primary transport and deposition, and secondary reworking. Primary stratification records dominance of low constant fluid motion and unidirectional sediment movement; crossbeds, subaqueous dune forms, occur locally. Burrows often destroyed primary stratification in thin sand and clay sequences; locally, in less aerated conditions between sand bodies, traces of nonburrowing organisms predominate. Identical processes occur in many environments, but associated suites of sedimentary structures record only the final and dominating processes prior to burial. Vertical succession reflecting changing patterns with time is the key to understanding distribution of processes and lithofacies in the paleogeographic environment. Interpretations of cores agree with previous interpretations of Cardium Sand as a shoal complex in a shallow shelf sea subject to tidal currents. — GDC

00840 **Milcoveanu, D.** Some formulas useful in the interpretation of gravitational and magnetic profiles: Geophysics, v. 35, no. 1, p. 66-79, illus., 1970.

General formulaa for the calculation of the gravimetric quantities g, g_x, g_{xx} and g_{xz} caused by two-dimensional models bounded by certain analytical curves are presented. Model curves show anomalies in these gravimetric quantities for the case of circular segments. On the basis of the well-known Poisson formula relating magnetic and gravimetric potentials, formulas are derived for the calculation of magnetic quantities produced by two-dimensional models bounded by certain analytical curves. Examples illustrate the case where the analytical curve is an arc of circle. Model curves show anomalies in the magnetic quantities for circular segments. The model curves representing theoretical gravimetric and magnetic anomalies can be used for practical interpretation problems. — Author's abstract

00968 **Milici, Robert C.** The Allegheny structural front in Tennessee and its regional tectonic implications: Am. Jour. Sci., v. 268, no. 2, p. 127-141, illus., 1970.

The Allegheny structural front in Tennessee separates thrust faults of different types. Thrusts in the Plateau northwest of the front are shear thrusts and formed without prior folding of footwall rocks. Thrusts in the Valley and Ridge are break thrusts and generally override a folded footwall terrane. The Cumberland Plateau, Valley and Ridge, and Blue Ridge of Tennessee are divided into four structural belts that record the transition from deformation by brittle failure on the northwest to plastic deformation on the southeast across the Appalachians. — Author's abstract

08405 **Milici, Robert C.** Geologic map (and two coal maps) of the Spencer quadrangle, Tennessee: Tennessee Div. Geology Geol. Map 103-NW, 3 sheets, scale 1:24,000, sections, separate text, 1969.

The coal maps show the Richland and Sewanee seams (with data on the Bon Air and Wilder seams), the main sources of coal in the Spencer quadrangle. There are 33 separately numbered coal mines or prospects, or groups of such mines, and 80 drill holes which give information on the four seams. Coal thickness is extremely variable; it is estimated that 800,000 tons have been mined. Recoverable reserves are probably about 8 million tons in the Richland and Sewanee seams. Limestone quarries are in the Bangor Limestone. Potential resources are dimension sandstone, sand, shale, and celestite. — MCM

00913 **Miller, Donald K.; Jackson, Kern C.** Fission tracks in micas and the rate of erosion [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 292-293, 1970.

00786 **Molenaar, Dee; Noble, John B.** Geology and related ground-water occurrence, southeastern Mason County, Washington: Washington Dept. Water Resources Water-Supply Bull. 29, 145 p., illus., tables, geol. map, 1970.

Southeastern Mason County is almost entirely within the Puget Sound Lowland and consists principally of glacial drift plains separated by stream valleys and marine embayments. Rocks exposed range in age from Eocene to Holocene; Tertiary volcanic rocks, with some consolidated sedimentary rocks, form the Black Hills. The major portion of the area is underlain by a thick sequence of unconsolidated glacial and nonglacial Pleistocene deposits, from oldest to youngest: Salmon Springs Drift and older undifferentiated sediments, Kitsap Formation, Skokomish Gravel, and Vashon Drift. Ground water for most needs is obtained principally from coarser phases of Salmon Springs Drift, Skokomish Gravel, and Vashon Drift. Older deposits provide large yields to deep industrial and municipal wells. The ground-water reservoir is recharged almost entirely from precipitation upon the land surface. Ground water is generally of good chemical quality. — *from* Authors' abstract

08415 **Molnia, Bruce.** Laboratory studies of mollusc shell abrasion [abs.]: Elisha Mitchell Sci. Soc. Jour., v. 85, no. 4, p. 123-124, 1969.

00740 **Molnia, Bruce F.; Pilkey, Orrin H.** Origin and distribution of carbonate fines on the North and South Carolina continental margin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 232, 1970.

00741 **Moore, Bruce R.; Blackburn, William H.; Navarro, Enrique.** Trend surface analysis applied to the interpretation of the source area of a turbidite sequence in the Missis-

sippian age Borden Formation, eastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 232-233, 1970.

Moore, Clyde H., Jr. *See* Facundus, Michael R. 00894

08356 **Moore, Gerald K.; Burchett, Charles R.; Bingham, Roy H.** Limestone hydrology in the upper Stones River basin, central Tennessee: [Nashville] Tennessee Dept. Conserv., Div. Water Resources, 58 p., illus., tables, geol. map, 1969.

This area in the Nashville basin is slightly rolling in the west and steeply dissected in the east, underlain by alternating massive and thin-bedded limestones of Ordovician age, without significant primary porosity. On a regional dome, many elongated synclines and small domes are superimposed. The synclines are interpreted as subsidence features resulting from underground solution in a block jointed system with strikes averaging N 45°E and N 45°W. Solution cavities range up to several feet high, ten to several hundred feet wide, and up to several miles long. Recharge appears to be limited to specific areas through sinkholes, with a sizeable storage capacity below level of stream beds; solution cavities comprise about 0.4 percent of the rock formations above this level; some of these segments are joint controlled. Slightly higher well yields are obtained where thick soils are developed along joints. — GDC

Moore, Nelson K. *See* Alberstadt, Leonard P. 00666

00914 **Moore, W. Richard.** Reduction of quartz grain size by diagenesis [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 293, 1970.

Morony, John J., Jr. *See* Cracraft, Joel. 08244

Morrison, D. A. *See* Reid, R. R. 00568

08372 **Morse, R. H.** Radium geochemistry applied to prospecting for uranium: Canadian Mining Jour., v. 90, no. 5, p. 75-76, illus., 1969.

The author has developed a rapid method for the relative determination of Ra^{226} in sediments and has applied it to prospecting for uranium. The method discriminates against radiation from thorium, potassium and other sources. — Author's abstract

Mowatt, T. C. *See* Crabb, D. E. 00601

Mowatt, T. C. *See* Helgerson, R. N. 00620

Mowatt, T. C. *See* Stach, R. L. 00645

00807 **Muehlberger, William R.** Memorial to Edwin Leslie Trice, Jr. (1929-1967): Geol. Soc. America Proc. 1967, p. 281, portrait, 1970.

Muehlberger, William R. *See* Fish, Johnnie E. 00896

08397 **Muhammed, Shah; McNeal, B. L.; Bower, C. A.; Pratt, P. F.** Modification of the high-salt water method for reclaiming sodic soils: Soil Sci., v. 108, no. 4, p. 249-256, illus., tables, 1969.

The application of successive dilutions of high-salt waters has proven successful for reclaiming sodic soils. Of the water series tested in this study, dilutions of sea water saturated with gypsum proved most effective for reclaiming sodic soils, followed by NaCl saturated with gypsum, mixtures of NaCl and $CaCl_2$ having a constant R value of 0.3 and dilutions of sea water (R value of 0.215). — JWH

00915 **Mutis-Duplat, Emilio.** Precambrian geology of a portion of the Purdy Hill quadrangle, Mason County, Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 293-294, 1970.

08292 **Myers, Arthur J.** Geology of the Alabaster Cavern area, *in* Guide to Alabaster Cavern and Woodward County, Oklahoma: Oklahoma Geol. Survey Guidebook 15, p. 6-16, illus., table, 1969.

Alabaster Caverns State Park has one of the largest known gypsum caves in the world; geologic history and stratigraphy of Woodward County are here reviewed. Permian bedrock was deposited in a fluctuating sea with periods of evaporation. Oldest exposed is the Flowerpot Shale with stringers of gypsum; in the overlying Blaine Formation of alternating gypsum and shale beds are five known caves, located in the Cimarron Gypsum Hills province, a low dissected bench along the Cimarron River; higher to the southwest, formations of the Whitehorse Group lie unconformably beneath Ogallala sandstone of Pliocene age, which is overlain by Pleistocene alluvial sand in a dune belt. Karst features are described, including small hollow mounds unknown in limestone karst, but formed by expansion of gypsum as it formed from anhydrite. The caves took shape in late Pleistocene time, major passages by stream erosion and ceiling channels by percolating vadose water in gypsum. — GDC

08293 **Myers, Arthur J.; Patrick, Carol R.** Description of recreation areas, *in* Guide to Alabaster Cavern and Woodward County, Oklahoma: Oklahoma Geol. Survey Guidebook 15, p. 16-24, illus., 1969.

Alabaster Cavern, at a maximum 60 feet wide and 50 feet high, is accessible for 2300 feet but probably extends half a mile more. Four other small caves are nearby; the largest, Upper Room, is very dry, its roof channeled in deep meanders by vadose water. Alabaster Cavern has an intermittent stream in the main channel, where its abrasive action is best shown; the deepest part holds a small lake, but most water has been diverted by dams. Collapse, dome, and channel sections are described, a cross-section showing relationships to roofing Medicine Lodge, Nescatunga, and Shimer Gypsums and shale beds of the Blaine Formation; the floor is the Flowerpot Shale. Fallen rocks in the collapse area include large boulders of selenite; the gypsum stalactites, compared to limestone, are quite small. Above the dome section, rainwater seeps through a cluster of sinkholes to undercut the ceiling in a series of high domes. — GDC

00757 **Nadeau, Joseph E.** Stratigraphy of the Leadville Limestone of central Colorado [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 341-342, 1970.

08310 **Nafe, J. E.; Drake, C. L.** Floor of the North Atlantic — Summary of geophysical data, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 59-87, illus., 1969.

Available geophysical data indicate that the region of the Atlantic Ocean north of 50° N is characterized by an almost complete absence of sub-moho velocities of 7.9-8.5 kmps, by a broad zone of positive free-air anomalies, by widespread volcanism, by magnetic anomalies in the ridge zone indicating a low rate of spreading that was rejuvenated recently, and by topography strongly reflecting the presence of nearby landmasses and the ridge structure. — *from* Authors' abstract

Nason, R. D. *See* Cloud, W. K. 00858

00578 **Nassichuk, W. W.** Permian ammonoids from Devon and Melville Islands, Canadian Arctic Archipelago: Jour. Paleontology, v. 44, no. 1, p. 77-97, illus., tables, 1970.

New collections of Permian ammonoids from the Assistance and Sabine Bay Formations in the southern Sverdrup Basin, Devon and Melville Islands, include species that closely resemble species from Upper Artinskian strata (Baigendzhinian) in the Ural Mountains in USSR: *Popanoceras* cf. *P. sobolewskyanum* and *Medlicottia* aff. *M. orbignyana*. *Synartinskia belcheri* n. sp., from the Assistance, is the first occurrence of the genus outside the USSR, where a single, less advanced species is known from Sakmarian strata. *Spirolegoceras fischeri* Miller, Furnish and Clark, from the upper Lower Permian Meade Peak Member of the Phosphoria Formation in Idaho, is shown to be closely related to Arctic species of *Sverdrupites* n. gen. The Assistance

Formation and the Meade Peak Member are considered to be of comparable late Early Permian age. — *from* Author's abstract

Navarro, Enrique. *See* Moore, Bruce R. 00741

Naylor, R. S. *See* Coombs, D. S. 00848

Neathery, Thornton L. *See* Bentley, Robert D. 00673

00742 **Neathery, Thornton L.; Bentley, Robert D.** Southern terminus of the Brevard fault zone [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 233, 1970.

00743 **Neff, James R.; Blankenship, Terry L.; Bonnett, Richard B.; Scrudato, Ronald J.** Teays River and lake deposits [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 233-234, 1970.

Nehru, C. E. *See* Stewart, John C. 08218

Neilson, James M. *See* Beveridge, Thomas R. 08249

Nelson, Samuel J. *See* Johnson, Ronald D. 08225

00973 **Neuschel, Sherman K.; Bunker, Carl M.** Correlation of uranium, thorium, and potassium with aeroradioactivity over a high-thorium pluton in the Berea area, Salem Church quadrangle, Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 234, 1970.

00916 **Nichols, Chester E.** Reconnaissance heavy metals survey in the Stoutland, Missouri quadrangle [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 294, 1970.

00824 **Nichols, Harvey.** Late Quaternary pollen diagrams from the Canadian Arctic barren grounds at Pelly Lake, northern Keewatin, N. W. T.: Arctic and Alpine Research, v. 2, no. 1, p. 43-61, illus., 1970.

Two peat monoliths near Pelly Lake, N. W. T., show accumulation of organic materials starting at 3,400 and 1,100 B.P. and ceasing after 900 B.P. Absolute pollen counts revealed parallel changes in representation of *Pinus* and *Picea* pollen, windblown into the area from the Boreal conifer forest 400 to 500 km to the south and west. Absolute numbers of pine and spruce pollen declined after 3,360 ± 70 B.P. to joint minima about 2,080 ± 60 B.P., rose to joint maxima at 900 ± 75 B.P. then decreased. The suggested climatic history is a period of cold summers after 3,400 B.P., with maximum severity about 2,100 B.P., a period of warm summers culminating about 900 B.P., then a cold dry phase, extending to the present, which stopped peat growth. Correlation of pollen diagrams with those from Ennadai Lake to the south suggest a parallel climatic history. Correlation of the late Quaternary climate with that of northwest Europe is outlined. — *from* Author's abstract

Nichols, Maynard M. *See* Ellison, Robert L. 00782

08382 **Nichols, Robert L.** Geomorphology of Inglefield Land, North Greenland: Medd. Grönland, v. 188, no. 1, 109 p., illus., tables, 1969.

In Inglefield Land in northwestern Greenland, Precambrian and early Paleozoic sedimentary rocks of the Thule group overlie a Precambrian erosion surface and are cut by a late Tertiary peneplain which was later uplifted. Fluvial dissection formed coastal cliffs, structural terraces and bedrock valleys. The submergence of the peneplain by the weight of the Icecap formed drowned valleys, promontories and coastal islands. Inglefield Land was completely glaciated during the Wisconsin, and transported till several feet thick covers the area. Numerous glacial and periglacial features are present. According to C-14 dating deglaciation occurred between 5900 to 7800 yr ago. The marine limit reached about 285 feet above sea level near Force Bugt and 210 feet at Dallas Bugt. The sea remained at the present level for some time as shown by modern deltas and marine cliffs. Waves and wind affected the area negligibly. The climate has remained arid for thousands of years. — EH

08385 **Nicol, David.** *Meiocardia floridana*, an overlooked Eocene pelecypod: Nautilus, v. 82, no. 4, p. 115-116, 1969.

The author is convinced that *Meiocardia palmerae* Nicol, 1968, is a synonym of *M. floridana* (Dall) 1900, which it strongly resembles. Nicol's specimen was collected from the Eocene Crystal River Formation, Florida, and Dall's, originally described as *Isocardia floridana* from the Vicksburgian Oligocene, seems certain to have come from the same strata and within the same geographic area. Only 13 specimens of the species are known. — ESL

00531 **Nigini, Andrew.** Prediction of ionic fluxes in rock alteration processes at elevated temperatures [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3243B, 1970.

Nishi, Charles K. *See* Prokopovich, Nikolas P. 00634

00630 **Noble, J. A.** Structural control of gold mineralization of Tertiary age in the northern Black Hills, South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 342, 1970.

Noble, John B. *See* Molenaar, Dee. 00786

Nokleberg, Warren J. *See* Page, Norman J. 00631

00793 **Nolan, Thomas B.** Memorial to Charles Findlay Davidson (1911-1967): Geol. Soc. America Proc. 1967, p. 185-191, portrait, 1970.

00917 **Noltimier, H. C.** A re-examination of a magnetic survey on the Spavinaw Granite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 294-295, 1970.

00918 **Norman, Carl E.** Geometric relationship of microfractures in brittle rock to rock structure and in situ rock stresses [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 295, 1970.

00919 **Norman, William S.** Clay mineralogy of Pleistocene and Holocene sediments on Louisiana continental shelf [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 295-296, 1970.

00920 **Norris, D. K.** Inclined flexural-slip folds in the eastern Canada Cordillera [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 296, 1970.

Northcutt, Fred. *See* Dexter, William A. 08394

00921 **Nygreen, Paul W.** An unusual palynological assemblage from the Ordovician of Oklahoma [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 296-297, 1970.

00744 **Nystrom, Paul G., Jr.** Slate belt stratigraphy near Pageland, South Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 234-235, 1970.

00582 **O'Connell, Richard John.** Pt. 1, Dynamic response of phase boundaries in the earth to surface loading; Pt. 2, Pleistocene glaciation and the viscosity of the lower mantle [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3243B, 1970.

00828 **Ollerenshaw, N. C.** Geology, Marble Mountain, west of fifth meridian, Alberta: Canada Geol. Survey Prelim. Ser. Map 7-1969, scale 1:50,000, sections, text, 1970.

Marble Mountain map-area at the easternmost limit of conspicuous Cordilleran deformation comprises parts of the western limb of the Alberta syncline, a transition zone, the Brazeau thrust sheet, and the Fallentimber thrust sheet. Oldest strata exposed at the surface belong to the Mississippian Banff Formation, lowest of the Rundle Group, which is overlain successively by the Jurassic Fernie Group, Lower Cretaceous Blairmore Group, Upper Cretaceous Alberta Group and Brazeau Formation, and the Paleocene Paskapoo Formation. Oil has been discovered in the northeast corner, probably in the Cardium Formation (Alberta Group). — MCM

08200 **Oltz, Donald F., Jr.** Numerical analyses of palynological data from Cretaceous and early Tertiary sediments in east central Montana: Palaeontographica, Abt. B, v. 128, nos. 3-6, p. 90-166, illus., tables, 1969.

Palynological analyses of five Upper Cretaceous and Lower Tertiary and one Lower Tertiary section suggests that there are minor ecological differences between sites of deposition which have close geographic proximity. These differences are reflected in the low numbers of coincidental species in the studied sections. Only 30 of 168 species were found to occur in common in all sections; they are designated as regional flora. An agglomerative procedure further suggests that certain species can be predicted to occur with those representing the 'regional' flora. Pollen analysis supports the change from floodplain to paludal conditions as the boundary is crossed. Over 160 species in 74 genera were recovered; one genus and 30 species are thought to be new. Dinoflagellates, hystrichosphaerids, and fungal spores were also recovered. — *from* Author's abstract

00950 **O'Neill, A. L.** Memorial to Elmer Chester Marliave (1910-1967): Geol. Soc. America Proc. 1967, p. 237-239, portrait, 1970.

Orosco, Cesar A. *See* Huffman, Samuel F. 00721

08418 **Osberg, Philip H.** Lower Paleozoic stratigraphy and structural geology, Green Mountain-Sutton Mountain anticlinorium, Vermont and southern Quebec, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 687-700, illus., 1969.

The Green Mountain-Sutton Mountain anticlinorium cuts at a low angle across a facies boundary between a predominantly miogeosynclinal sequence on the west and a predominantly eugeosynclinal sequence on the east. The two facies are dissimilar in stratigraphy, but approximate equivalence between them can be ascertained by tracing units through facies boundar , in northwestern Vermont and southern Quebec. Unconformities have been identified at the base of the Cambrian (?) and of the Trentonian section. Lesser unconformities are suggested in the Upper Cambrian in northwestern Vermont and southern Quebec, and at the base of the Upper Ordovician in Quebec. Position of the anticlinorium coincides with that of ancestral geanticlines of medial Ordovician and post-medial Ordovician to Silurian ages. The present anticlinorium is probably Acadian overprinted on its predecessor. — *from* Author's summary

00574 **Ovenshine, A. Thomas.** Observations of iceberg rafting in Glacier Bay, Alaska, and the identification of ancient ice-rafted deposits: Geol. Soc. America Bull., v. 81, no. 3, p. 891-894, illus., 1970.

Observations of icebergs in a modern glacial marine environment indicate that ancient rocks that received iceberg-rafted material should contain: (1) local concentrations of stones that originated when icebergs overturned, and (2) small pellets of till that were originally sediment filling the spaces between clear ice crystals. The till pellets are especially significant in identifying an ancient glacial setting because they originate through a process unique to glaciers. Thus when freed by melting and deposited by iceberg rafting, the pellets would reliably indicate the presence of glacial ice in an ancient environment. In the Gowganda Formation, a Precambrian glacial deposit, strata that contain outsized, presumably iceberg-rafted stones also contain abundant small flattened clasts of unsorted graywacke interpreted as the lithified counterparts of the till pellets observed on modern icebergs. — *from* Author's abstract

00817 **Oversby, Virginia M.** The isotopic composition of lead in iron meteorites: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 65-75, illus., tables, 1970.

Lead isotopic composition and lead concentration were measured in four troilite samples from Canyon Diablo, two troilites from Toluca, and single troilites from Bogou, Baquedano, Gibeon, Grant and Staunton. Uranium concentrations were measured in four samples; they ranged from 2.6 to 25 ppb. Observed isotopic com-

positions were corrected for fractionation by the double spike technique. The lead compositions ranged from primitive compositions to modern radiogenic compositions. It is concluded that the radiogenic lead found in iron meteorites is due to terrestrial contamination. New values recommended for the primordial lead ratios are Pb-206/Pb-204 = 9.346, Pb-207/Pb-204 = 10.218, and Pb-208/Pb-204 = 28.96. — Author's abstract

00922 **Overton, Harold L.** Salinity anomalies in marine sands [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 297, 1970.

00923 **Padovani, E. Reeves.** Devonian acritarchs from the Cedar Valley Formation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 297, 1970.

00575 **Page, Benjamin M.** Sur-Nacimiento fault zone of California — Continental margin tectonics: Geol. Soc. America Bull., v. 81, no. 3, p. 667-689, illus., table, geol. map, 1970.

The Sur-Nacimiento fault zone forms the boundary between the Franciscan assemblage on the southwest and the granitic and metamorphic rocks of the Salinian block on the northeast. The fault zone originated at the former margin of the continent during latest Cretaceous or early Tertiary time as the culmination of processes that operated during the entire late Mesozoic. During the late Mesozoic, Franciscan deposits were probably carried into a trench, far offshore, and pushed against or partly beneath the crust to the east, by ocean-floor spreading. Conveyor-belt action of eastward moving oceanic crust impinging beneath the continent edge may have ripped off and carried down blocks of sialic crust. Perhaps this was the mechanism that brought the Franciscan against the Salinian granite, creating the ancestral Sur fault zone. — *from* Author's abstract

00631 **Page, Norman J.; Nokleberg, Warren J.** A suite of granitic intrusive rocks below the base of the Stillwater complex, Mount Wood quadrangle, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 342, 1970.

08313 **Palmer, Allison R.** Cambrian trilobite distributions in North America and their bearing on Cambrian paleogeography of Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 139-144, illus., 1969.

Interpretation of the Cambrian paleogeography of Newfoundland is aided by study of the distribution of Cambrian trilobite faunas of North America. Symmetry in the distribution of Cambrian trilobites and a crude concentric zonation of the Cambrian trilobite provinces in North America are apparent. There are two almost completely distinct Cambrian faunal and stratigraphic successions in Newfoundland. The faunas of the eastern part of Newfoundland are entirely of European aspect, whereas those of western Newfoundland include European elements as only a minor part of the total fauna. The available evidence seems to suggest the presence of a marine basin in central Newfoundland during Cambrian time. — Author's abstract

00746 **Palmer, James E.** Fault scarp exposures in the Saint Charles and Nortonville quadrangles, western Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 235, 1970.

00569 **Parker, Ronald B.; Toots, Heinrich.** Minor elements in fossil bone: Geol. Soc. America Bull., v. 81, no. 3, p. 925-932, illus., tables, 1970.

Electron microprobe analysis was used to determine the specific sites at which minor elements are concentrated in fossil bone. Sodium and strontium are incorporated into the apatite crystal structure mainly during the life of the animal. Fluorine and yttrium also enter the apatite structure, but their presence is due to postmortal enrichment and is controlled mainly by availability of the element, and time, and, to a lesser degree, environmental conditions. Silicon, manganese, and iron are present in the form of separate minerals filling voids of all sizes in the bone structure. Their addition is clearly postmortal and reflects the diagenetic environment. Arsenic, barium,

lead, thorium, uranium, and various rare earth elements have also been detected in fossil bones, but their specific location and time of incorporation into the bone have not been determined. — *from* Authors' abstract

08373 **Parrish, I. S.** Inclined sections — A practical approach to mine geology: Canadian Mining Jour., v. 90, no. 7, p. 47-50, illus., 1969.

The inclined section, a plane drawn perpendicular to the strike of any particular feature and sloping at any angle between 0° and 90°, can be used to illustrate and substantiate interpretations made from longitudinal diagrams, and for orebodies with moderate rake becomes a valuable exploration aid. Construction is similar to that of a cross section. Three examples illustrate areas of application as well as methods of construction. The section can be drawn so as to avoid post-ore deformatory structures, and to cross any feature, and may be a more valid section of an orebody than a cross section. — ESL

Parry, W. T. *See* Barnes, M. P. 08251

Parry, W. T. *See* Reeves, C. C., Jr. 08285

Pasley, Susan M. *See* Thompson, Geoffrey. 00853

08262 **Paterson, Norman.** Rebuttal [to] "Applications and limitations of airborne electromagnetic systems in mineral exploration," by R. Bosschart and R. Pemberton, 1969: Mining in Canada [v. 42], July/Aug., p. 45, 47-48, 1969.

Bosschart's and Pemberton's conclusions (ibid.; May 1969, p. 19-281; Abstracts of North American Geology, Jan. 1970) are based on some rather questionable observations, which are examined. Paterson quotes facts to show that AFMAG and VLF surveys do locate sulfides; that anomalies shown in Cavendish Township, Ontario, are real; that these methods are gaining in popularity, rather than losing; that imaginary component systems are capable of finding massive sulfides; and that decrease of anomaly with height is a function of coil separation rather than geometry. The authors make the common mistake of confusing unwanted geologic response with unwanted geologic anomaly. — ESL

Patrick, Carol R. *See* Myers, Arthur J. 08293

Patterson, O. F., 3d. *See* Hope, R. C. 08363

Patterson, O. F., 3d. *See* Hope, R. C. 08411

00924 **Patty, Tom S.** Industrial mineral utilization by the Texas Highway Department [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 297, 1970.

00632 **Paull, Richard A.** Evidence against the existence of the Antler orogenic belt in central Idaho [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 343, 1970.

08399 **Pauly, Hans.** White cast iron with cohenite, schreibersite, and sulphides from Tertiary basalts on Disko, Greenland [with Danish abs.]: Dansk Geol. Foren. Medd., v. 19, no. 1, p. 8-26, illus., 1969.

On Disko island, west coast of Greenland, native iron occurs locally in masses, and as tiny grains scattered through basalt flows covering hundreds of square kilometers. The iron was formed by interaction of the basalts with bituminous shales; C-12:C-13 ratios indicate organic origin of the graphite in the basalts. Etched polished sections of the iron from Uivfaq show iron and cohenite, Fe_3C containing some Ni and Co, in a fine-grained intergrowth; pearlite, with lamellae of cohenite; sulfides; and the Fe-Ni phosphide schreibersite. A simplified Fe-C diagram shows the approximate composition of the Uivfaq iron; rapid cooling from above 1250° to about 600°C accounts for the fineness of the pearlite and possibly the stabilization of the cohenite. Steenstrup (1876, 1883) and Tornebohm (1878) recognized the essential features of the deposits. — VMJ

00583 **Pawlowicz, Edmund Frank.** An isostatic study of northern and central Greenland based on gravity values and airborne radar ice-thickness measurements [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3247B, 1970.

08247 **Pederson, Darryll T.; Reid, John R.** (editors). Geology of northeastern North Dakota — Guidebook and short summaries prepared for the annual meetings of the North Central Section, National Association of Geology Teachers, Grand Forks, N. Dak., April 25-26, 1969: North Dakota Geol. Survey Misc. Ser., no. 39, 30 p., illus., 1969.

This guidebook has individual stop descriptions that could be used for one-stop field trips, with special reference to a particular exposure or landform. The sites in the Red River Valley area, primarily in Grand Forks and Walsh Counties, are related to physiography of Nelson County and the remainder of the state. The general setting is on the floor of glacial Lake Agassiz, which once extended far north over an area larger than all the Great Lakes combined. Review of geologic history includes the continental glaciation which dammed the Red River, and subsequent lake levels as shown by beach ridges and drainage deltas in North Dakota, and associated glacial features. Ice-drag lineations are similar to patterns shown on airphotos of the Great Slave Lake area in Canada, but ridges here are grooves there. — GDC

00564 **Pestana, Harold R.; Bonta, Bruce D.** Congressional geology: Geol. Soc. America Bull., v. 81, no. 3, p. 899-903, 1970.

During the 19th and early 20th centuries the U.S. Congress published many geologic reports. Most of these are not listed in the usual bibliographies or indexes. This note discusses congressional publications and lists and describes typical geologic documents. — Authors' abstract

00956 **Peterman, Zell E.; Hedge, Carl E.; Tourtelot, Harry A.** Isotopic composition of strontium in sea water throughout Phanerozoic time: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 105-120, illus., tables, 1970.

Isotopic analyses of strontium in primary fossil carbonate reveal significant variations in Sr-87/Sr-86 of sea water during the Phanerozoic. The strontium isotopic composition may have been uniform from Ordovician through Mississippian, with an average Sr-87/Sr-86 of 0.7087. A subsequent decrease in this value into the Mesozoic is interrupted by two provisionally documented positive pulses in Sr-87/Sr-86 — one in Early Pennsylvanian and one in Early Triassic. The lowest observed value (0.7068) occurred in Late Jurassic time, and this was followed by a gradual increase to 0.7075 in Late Cretaceous and a more rapid increase through Tertiary to 0.7090 for modern sea water. These variations are thought to be the results of complex interplay of periods of intense volcanism and epeirogenic movements of continents on a worldwide scale. — Authors' abstract

Peterson, Donald L. *See* Eaton, Gordon P. 00609

00747 **Peterson, Warren L.; Kepferle, Roy C.** Deltaic deposits of the Borden Formation (Mississippian) in central Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 236, 1970.

00752 **Philcox, M. E.** Coral bioherms in the Hopkinton Formation (Silurian), Iowa: Geol. Soc. America Bull., v. 81, no. 3, p. 969-973, illus., 1970.

Groups of bioherms about 20 ft thick are exposed in the Hopkinton Formation at two localities. Bioherm cores contain scattered coral colonies up to 6 ft high in a fine dolomitic matrix. Dipping flank beds consist mainly of crinoid debris, with common stromatoporoids near the core. Coral growth forms seem to indicate that sedimentation in the cores generally kept pace with upward growth of the colonies. Lateral expansion of colonies was possible when the sedimentation rate fell; partial (or complete) burial of colony growth surfaces occurred when the rate increased. Similar coral bioherms are unknown elsewhere in the Silurian of the Midwest-Great Lakes area. — Authors' abstract

00748 **Philley, John C.; Dever, Garland R., Jr.** St. Louis-Ste. Genevieve relationships in northeastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 236-237, 1970.

08315 **Phillips, W. E. A.; Kennedy, M. J.; Dunlop, G. M.** Geologic comparison of western Ireland and northeastern Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 194-211, illus., tables, 1969.

Similarities in the stratigraphic and structural histories of the Caledonides of western Ireland and of the Appalachian belt in the Burlington Peninsula of Newfoundland are examined. A Precambrian metamorphic basement is probably common to both areas. The late Precambrian or early Paleozoic Fleur de Lys Group of Newfoundland is comparable to the Dalradian rocks in Ireland; in particular, the polyphase structures and metamorphism of the Fleur de Lys are very similar to those of the Erris Schist Group of northern Mayo. A Silurian shoreline and volcanic center northwest of Clew Bay can be correlated with subaerial volcanic rocks in the Burlington Peninsula, and Silurian deformation styles and intensities are similar. Major fault continuity is also a possibility. The entire body of similarities provide consistent evidence for a post-Carboniferous drift which increased separation between Newfoundland and western Ireland. — VSN

08201 **Philpotts, John A.; Schnetzler, C. C.; Hart, S. R.** Submarine basalts — Some K, Rb, Sr, Ba, rare-earth, H_2O, and CO_2 data bearing on their alteration, modification by plagioclase, and possible source materials: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 293-299, illus., table, 1969.

Typical sea-water alteration of submarine basalts apparently effects little change in their Sr and rare-earth concentrations, in general, and enrichments or depletions of Ba of up to about 50 percent. The trace-element data indicate that plagioclase has had an important effect in modifying composition. A simple model indicates eclogite or garnet peridotite as the most likely source rocks of alkali and submarine basalts. — Authors' abstract

Pickens, W. R. *See* Klohn, M. L. 08256

00839 **Pickett, G. R.** Applications for borehole geophysics in geophysical exploration: Geophysics, v. 35, no. 1, p. 81-92, illus., tables, 1970.

Most geophysicists are familiar with the use of well logs for stratigraphic correlation and perhaps for estimating volumes of oil and gas in place. Additions to the array of available borehole measurement techniques have led to additional capabilities. Several dozen borehole measurements are currently available whose potential applications include estimation of recoverable hydrocarbons from reservoirs, identification of geologic environments, derivation of compressional and shear-wave velocities and attenuations, quantitative measurements of lithology, identification of "flushed" hydrocarbon reservoirs and fluid migration paths, and identification of potential reservoirs. A better marriage of borehole geophysics to surface exploration techniques should be rewarding both to the borehole specialist and to the surface explorationist. — *from* Author's abstract

00842 **Pickett, G. R.; Artus, D. S.** Prediction from logs of recoverable hydrocarbon volume, Ordovician carbonates — Williston basin: Geophysics, v. 35, no. 1, p. 113-123, illus., table, 1970.

This study was to develop techniques for predicting from well logs the quantity of recoverable oil by primary depletion from the upper Red River formation (Cedar Creek Anticline) in the Williston basin. Means of providing appropriate rock type zonation from routinely run logs for geological purposes were also desired. A technique for calculating from logs the ratio of permeability to air measured in cores (k) and porosity (ϕ), was determined. In the Red River, the parameter k/ϕ is useful for classifying rocks by pore-size ranges. A quantitative correlation between primary oil recovery from production decline curves and total oil saturation calculated from

logs is developed for the Red River formation. The method uses calculated values of k/ϕ to divide zones into appropriate classes of rock quality in terms of pore-size range for the summation. — *from* Authors' abstract

00749 **Pierce, J. W.; So, C. L.; Roth, H. Daniel; Colquhoun, D. J.** Wave refraction and coastal erosion, southern Virginia and northern North Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 237, 1970.

Pilkey, Orrin H. *See* Molnia, Bruce F. 00740

08198 **Pirson, Sylvain J.** Geological, geophysical, and chemical modifications of sediments in the environment of oil fields, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 159-186, illus., 1969.

A water-borne process of hydrocarbon migration and accumulation is nearly universally accepted as the primary natural means of collecting oil and gas in structural as well as stratigraphic traps. This process calls for large volumes of fluid transfer during the time elapsed from sedimentation to the present. It is postulated and it is verified by field examples that radioactive elements may be used as tracers of fluid motion throughout geologic time and that significant radioactive-mapping patterns are derivable from gamma-ray logs which are characteristic of hydrocarbon accumulations at depth. Hydrocarbons also leak from their loci of entrapment, thereby modifying the physico-chemical properties of overlying sediments, more specifically their redox potential. — Author's abstract

00750 **Pojeta, John, Jr.** Silicified pelecypods from the Lexington Limestone (Ordovician) of Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 238, 1970.

Polach, H. A. *See* Williams, G. E. 08204

00515 **Poole, Donald Hudson.** Slope failure forms — Their identification, characteristics, and distribution as depicted by selected remote sensor returns [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3235B-3236B, 1970.

00925 **Potter, Delbert E.** Palynology and environmental analysis of Upper Pennsylvanian strata, Keystone Reservoir area, Oklahoma [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 297-298, 1970.

Potter, Paul Edwin. *See* Hrabar, S. V. 00719

Powers, H. A. *See* Izett, G. A. 00622

00751 **Prather, Preston; Radcliffe, Dennis.** Petrology of the norites of Monroe County, Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 238, 1970.

Pratt, P. F. *See* Muhammed, Shah. 08397

08391 **Prescott, Glenn C., Jr.** Ground-water favorability areas and surficial geology of the lower Kennebec River basin, Maine: U.S. Geol. Survey Hydrol. Inv. Atlas HA-337, scale 1:62,500, text, 1969.

Areas most favorable for location of wells yielding more than 50 gpm are those with stratified sand and gravel of glaciofluvial origin, particularly ice-contact deposits; largest yields are in valleys. Ground-water levels and streamflow respond more to seasonal climatic changes than directly to precipitation. Yields of bedrock wells range from 0 to 67 gpm. Ground-water quality in general is good, generally low in dissolved solids and free from most constituents limiting its usefulness. — MCM

00559 **Preto, V. A. G.** Amphibolites from the Grand Forks quadrangle of British Columbia, Canada: Geol. Soc. America Bull., v. 81, no. 3, p. 763-782, illus., tables, 1970.

Major and trace element analyses of 30 amphibolites from the Grand Forks Group, a fault block unit of the high grade metamorphic Shuswap Complex, are presented and evaluated by various plots to determine whether the amphibolites are of igneous or sedimentary parentage. It is concluded that the amphibolites are metamorphosed basic intrusions with perhaps some associated extrusive material. Schistose, lineated, and massive textural varieties are regarded as products of metamorphic history and not relics of primary structures. — RGY

00571 **Prinz, Martin.** Idaho rift system, Snake River plain, Idaho: Geol. Soc. America Bull., v. 81, no. 3, p. 941-947, illus., 1970.

The Idaho Rift System a 62 mile-long fissure zone consists of four en echelon rift sets that arc across the Snake River plain from north to northwest. The rift sets from north to south are: (1) Great Rift set, N. 35° W., mostly in Craters of the Moon National Monument, (2) Open-Crack rift set, N. 30° W. from which almost no volcanic products were emitted; (3) King's Bowl rift set, N. 10° W., open 800 feet to watertable; (4) Wapi rift set, N-S, presumed present beneath Wapi lava field. A radiocarbon date of 2130 ± 130 yr. for the King's Bowl rift is presumed to represent the opening of the system. The tectonic significance is difficult to evaluate; it may be related to crustal plate movements or to fault-block ranges flanking the plain. —*from* Author's abstract

00814 **Prior, D. B.; Ho, C.** Bentonite landslides [discussion of paper by D. M. Anderson; R. C. Reynolds; J. Brown, 1969]: Science, v. 167, no. 3920, p. 1014-1015, table, 1970.

Issue is taken with the statement of Anderson and others (ibid., v. 164, no. 3876, p. 173-174) that bentonite debris flows are unique to the Arctic environment. Examples of similar flows are cited from several other geographic locations and it is concluded that the primary factor in the locations of many flow-type landslides is not a simple climatic one but rather the presence of bentonite clay minerals in the slope materials. The distribution of bentonite landslides is thus largely geologically controlled. — GV

Prior, Jean C. *See* Ruhe, Robert V. 00615

00634 **Prokopovich, Nikolas P.; Nishi, Charles K.** Lithology and chemistry of San Joaquin Valley alluvium near South Dos Palos, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 344, 1970.

00821 **Puchelt, H.; Kullerud, G.** Sulfur isotope fractionation in the Pb-S system: Earth and Planetary Sci. Letters, v. 7, no. 4, p. 301-306, illus., table, 1970.

Silica tube experiments on S-isotope fractionation among phases of the Pb-S system indicate strong kinetic effects when Pb reacts with S to form PbS. Difference in reaction rates of S-32 and S-34 gives lead sulfide enriched in light S-isotope. The most pronounced effect was recorded at the moment when all Pb had reacted. After establishment of phase equilibrium a period of S-isotope homogenization follows and an equilibrium fractionation factor of 1.0025 results at 300°C. Isotopic equilibrium at this temperature was reached three orders of magnitude more slowly than was phase equilibrium. Reaction rate of isotope homogenization is strongly dependent on temperature and is 100 times faster at 500° than at 400°C. Experiments showed that natural galena rapidly exchanges sulfur with sulfur vapor; galenas in ores may exchange isotopes with vapors that contain sulfur and lose initial isotope ratios. — *from* Authors' abstract

00800 **Pugh, William J.** Memorial to Owen Thomas Jones (1878-1967): Geol. Soc. America Proc. 1967, p. 219-235, portrait, 1970.

Pulvertaft, T. C. R. *See* Rosenkrantz, A. 08344

Pyle, Thomas E. *See* Antoine, John W. 00861

Querol-Suñé, F. *See* Luth, W. C. 00855

00926 **Quinn, James H.** Occurrence of *Sus* in North America [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 298, 1970.

Radcliffe, Dennis. *See* Humphrey, Ronald. 00722

Radcliffe, Dennis. *See* Prather, Preston. 00751

00511 **Radhakrishnan, Narayanaswamy.** Solution of some plane strain problems in soil mechanics using the method of finite elements [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3166B-3167B, 1970.

00758 **Ragland, Paul C.** Subsolidus unmixing and inversion of potassium feldspars from a granitic batholith [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 239, 1970.

Rainville, George D. *See* Bombolakis, Emanuel G. 00868

00510 **Ramanjaneya, Gundarlahalli Sankarasetty.** Consolidation characteristics of a varved clay [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3167B-3168B, 1970.

00927 **Ramsay, John G.** Geometric stability of chevron and kink folds [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 298-299, 1970.

00635 **Ramsden, John.** A new method of producing orientation diagrams for till fabrics [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 344, 1970.

Rankin, Douglas W. *See* Espenshade, Gilbert H. 00696

08263 **Ranko, Vaino.** Rebuttal [to] "Applications and limitations of airborne electromagnetic systems in mineral exploration," by R. Bosschart and R. Pemberton, 1969: Mining in Canada, [v. 42] July/Aug., p. 48, 50-51, 1969.

Ranko comments on the disturbingly low accuracy and lack of objectivity in the paper (ibid., May 1969, p. 19-28; Abstracts of North American Geology, Jan. 1970), but believes it is due to the fact that the authors are employees of one of the companies engaged in competitive geophysical instrumentation. The second reason for comment is that the authors have attacked two methods, the airborne dual-frequency imaginary component EM-system and the VLF-method. Ranko has found that imaginary component systems are capable of detecting good conductors; the VLF system has also proved to be an effective and valuable tool. What the authors refer to as geologic noise in the Ontario profile, a professional interpreter would call anomalies. — ESL

08240 **Ransone, W. R.** Case history of the Sixto oil field, Starr County, Texas, a geochemical discovery, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 187-196, illus., 1969.

The exploration history of the Sixto oil field is unusual in that its discovery followed the drilling on a geochemical anomaly without the use of geophysics or core drill. Geology indicated very gentle anticlinal nosing with slight flattening along the axis of the nose and no structural closure. Subsequent development substantiated the early geology and revealed that six dry holes had been drilled through the pay zone prior to discovery. Unusual amounts of silt and bentonitic clay in the pay sand, along with a shell cap, affected the electric-log characteristics and made recognition of the sand as oil-bearing very difficult. This sand condition also made well completion difficult; this was overcome by using oil-base drilling mud. — Author's abstract

Raring, Andrew M. *See* Fowler, Michael L. 00702

00636 **Ratté, James C.; Zartman, Robert E.** Bear Mountain gneiss dome, Black Hills, South Dakota — Age and structure [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 345, 1970.

00928 **Ratzlaff, John R.; Dort, Wakefield, Jr.** Late Quaternary channel pattern and lateral behavior, middle part of Kansas River, Kansas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 299, 1970.

08426 **Rau, Jon L.** Hydrogeology of the Berea and Cussewago Sandstones in northeastern Ohio: U.S. Geol. Survey Hydrol. Inv. Atlas HA-341, 2 sheets, scale 1:250,000, text, 1969.

Four maps show respectively the thickness and structure of, and availability and quality of water in, the Berea and Cussewago Sandstones. Thickness of the Berea (average 50 feet) ranges from a few feet near the edge of the outcrop area to more than 235 feet at South Amherst. In general, thickness is important in determining well yield, although there are local variations. The Cussewago is coarser grained than typical Berea and locally is so soft that it has a tendency to cave from the sides of well holes. Average yield of the Berea is about 18 gpm, of the Cussewago, 26 gpm. Favorable conditions for recharge are in relatively wide outcrop areas where sandstones are fractured and jointed near the surface and where surfaces have low relief. Water from deep wells in the Berea generally contains more mineral matter in solution than does water from shallow wells, and below an altitude of 750 feet above mean sea level contains salt water. — MCM

00532 **Raymond, Charles Forest.** Flow in a transverse section of Athabasca Glacier, Alberta, Canada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3244B, 1970.

Rector, Roger J. *See* Clifford, Paul M. 00882

00822 **Rees, C. E.** The sulphur isotope balance of the ocean — An improved model: Earth and Planetary Sci. Letters, v. 7, no. 4, p. 366-370, 1970.

Previous explanations of the variations in the sulfur isotope composition of ocean sulfate over geological time have related them to gross changes with time of the ocean sulfate content. These explanations have disregarded the role of sulfate evaporite formation as a mechanism which (in competition with bacterial sulfate reduction) controls the net iotope fractionation in the ocean sulfate reservoir. The nature of this control is demonstrated and is shown that in fact variations of isotopic composition of ocean sulfate might not be unequivocally related to changes in the total sulfur content of the ocean. — Author's abstract

08285 **Reeves, C. C., Jr.; Parry, W. T.** Age and morphology of small lake basins, southern High Plains, Texas and eastern New Mexico: Texas Jour. Sci., v. 20, no. 4, p. 349-354, illus., 1969.

The majority of small lake basins of the southern High Plains, Texas and eastern New Mexico, were formed mainly by deflation during the Vigo Park and Altithermal intervals, 17,000 and 6,500-5,000 years B.P. respectively. Smaller basins, without fringing dunes, represent deflation during post-Altithermal time. Shapes of the lake basins reflect origin and age. Basins along abandoned stream channels are elongate. Recent blowouts are circular, and older basins now altered by end-current erosion are subcircular to elliptical. — Authors' abstract

00637 **Reid, John R.** Surging as an explanation of the neoglacial limit, Martin River Glacier, Alaska [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 345, 1970.

Reid, John R. *See* Pederson, Darryll T. 08247

00568 **Reid, R. R.; Greenwood, W. R.; Morrison, D. A.** Precambrian metamorphism of the Belt Supergroup in Idaho: Geol. Soc. America Bull., v. 81, no. 3, p. 915-917, illus., table, 1970.

Radiometric dating of zircon indicates a 1525 ± 82 m.y. age of crystallization for augen gneiss that intrudes metasedimentary rocks (near Elk City, Idaho) correlated with the Prichard Formation of the Belt Supergroup. The augen gneiss appears to be late synkinematic with the first deformation and metamorphic event in the metasedi-

mentary rocks. Therefore, the first deformation and metamorphism are also Precambrian in age. Diopside-gneiss-bearing rocks on the Lochsa River, Idaho, correlated to the Wallace Formation of the Belt Supergroup, have a structural history similar to the rocks intruded by augen gneiss. Therefore, the diopside-gneiss-bearing rocks also were metamorphosed at 1525 m.y. — Authors' abstract

Reid, William M. *See* Kehle, Ralph O. 00900

Reilly, Edgar M., Jr. *See* Funk, Robert E. 00963

00638 **Remson, Irwin.** Hydrogeologic models in urban planning [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 346, 1970.

Renaud, A. *See* Alder, B. 08396

00929 **Rezak, R.; Edwards, G. S.** Carbonate sediments of the Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 299-300, 1970.

00759 **Rice, Charles L.** Facies in the Kendrick Shale of eastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 239, 1970.

00639 **Rice, Lee R.; Luza, Kenneth V.** Factors controlling stream pollution related to bog iron ore mining in the north-central Black Hills, South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 346, 1970.

Richter, Charles F. *See* Anderson, Don L. 00811

08383 **Richter, Charles F.** Earthquakes: Nat. History, v. 78, no. 10, p. 36-45, illus., 1969.

Few people realize that great losses from earthquakes are almost wholly preventable. The author regrets the emphasis on prediction because it takes attention away from measures to remove known risks. A discussion of the nature of earthquakes includes fracturing of rocks and damage to structures crossing faults; effects of seismic waves and the role of foundation material; invention of seismographs, including description; the growth of seismology with improved instruments; types of waves; information on Earth's interior; and earthquake belts and global tectonics. Regionalization, or risk, maps are useful in planning construction. The terms intensity and magnitude are defined and distinguished. Worldwide occurrence of earthquakes averages 20 major, including one or two great quakes a year, and about a million total. Tsunamis, and the height of buildings in risk areas are touched on briefly, and efforts toward prediction reviewed. — ESL

00930 **Riecker, Robert E.; Rooney, Thomas P.** Amphibole deformation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 300, 1970.

00546 **Rigby, J. Keith.** Two new Upper Devonian hexactinellid sponges from Alberta: Jour. Paleontology, v. 44, no. 1, p. 7-16, illus., table, 1970.

Two new hexactinellid [lyssakid] sponges, *Mattaspongia apaches* and *Pelicaspongia sterea*, are described from well preserved specimens. New genera *Mattaspongia* and *Pelicaspongia* are the bases of the new families, Mattaspongiidae and Pelicaspongiidae, in the Protospongioidea and Brachiospongioidea, respectively. The specimens were collected from the Upper Devonian (Frasnian) Mount Hawk Formation and equivalent beds in the Ram and Hummingbird Ranges in the Front Ranges of the Canadian Rocky Mountains. Root tuft (?) spicules on two shale fragments are described from the Ram Range. — Author's abstract

08328 **Riva, John.** Middle and Upper Ordovician graptolite faunas of St. Lawrence Lowlands of Quebec, and of Anticosti Island, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 513-556, illus., table, 1969.

Graptolite fauna of Canajoharie-Utica shale of St. Lawrence Lowlands and Anticosti Island are grouped into four zonal assemblages, simplifying zonation proposed by Ruedemann. The Canajoharie is restricted to the lower and middle members of Ruedemann, and the upper is included in the Utica. Disappearance of the faunal assemblages of the Utica marks a reliable boundary between Middle and Upper Ordovician for graptolite-bearing strata of northeastern North America. The Lorraine Group of St. Lawrence Lowlands and similar formations of Anticosti contain three additional assemblages. It is apparent that Richmondian is not correlative with strata bearing Ashgillian graptolites and the known standard graptolite successions are incomplete with respect to Anticosti succession. Comparisons are made with the Mohawk Valley of New York and Marathon region of Texas. — VSN

Rizer, William D. *See* Bombolakis, Emanuel G. 00868

Robbart, F. *See* Colmet-Daage, F. 08358

Robertson, W. A. *See* Irving, E. 00656

Robinson, P. D. *See* Fang, J. H. 08362

00835 **Roesset, J. M.** Fundamentals of soil amplification, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 183-244, illus., 1970.

The effect of local soil conditions on shear-wave earthquake motions is investigated and the spectrum at the top of a layered soil is obtained for a given earthquake spectrum at bedrock. The problem is solved in two alternate ways: (1) by using the wave equation, and (2) by replacing the layered column by a system of lumped masses connected by springs and dashpots. — BFG

Rogers, D. H. *See* VanNest, J. P. 08380

Rogers, John J. W. *See* Leeman, William P. 00854

Rogers, John J. W. *See* McKay, Gordon A. 00910

Rooney, Thomas P. *See* Riecker, Robert E. 00930

00612 **Root, Samuel I.** Structure of the northern terminus of the Blue Ridge in Pennsylvania: Geol. Soc. America Bull. v. 81, no. 3, p. 815-830, illus., table, 1970.

The northernmost extension of the Blue Ridge is an anticlinorium in rocks of Precambrian through Ordovician age. Only one orogenic period of deformation is apparent but several stages can be recognized within the orogeny. The tectonic grain of this region is disrupted by an east-trending right-lateral tear fault and the abrupt change in strike of tectonic elements accounts for what has been considered as an arcuation of the Blue Ridge. A proposed Cornwall-Kelvin right-lateral basement dislocation along lat 40° N. could account for some of the observed Blue Ridge structure. However, strike-slip faulting is not compatible with paleomagnetic data and certain structural evidence. Probably an early Paleozoic arcuate structure in the Piedmont, east of the Blue Ridge, influenced the later structures. — EHP

00760 **Roper, Paul J.; Dunn, David E.** Structural evolution of northwestern South Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 239-240, 1970.

08222 **Roper, William A.; Jones, Vaughn A., Jr.** Improved simultaneous determination of formation properties from well logs: Jour. Petroleum Technology, v. 21, July, p. 827-235, illus., tables, 1969.

A well log computation technique, similar to one developed earlier, can be used to differentiate the separate contributions of many possible minerals. The scheme may be extended to include the effects of resistivity tools as they relate to porosity and saturation. — Editor's abstract

08370 **Rose, E. R.** Vanadium — Its occurrence and prospects in Canada, *in* Guidelines to prospecting — A symposium: Canadian Mining Jour., v. 90, no. 4, p. 102-104, illus., 1969.

Uses and occurrence of vanadium are reviewed, including that in sandstone ores in the United States. A chemical method of detecting and identifying vanadium is given. Association of vanadium with uranium-bearing ores at Beaverlodge suggests that other uranium occurrences should be investigated, and uranium-vanadium sandstones and shales like those of the Colorado Plateau should be expected in basins of the Great Plains and Cordillera. Lignites and Athabasca tar sands carry traces of vanadium, and large titaniferous magnetite deposits carry potentially valuable vanadium. Prospecting guidelines are: most ores resemble dirty sandstones or graywackes; in advanced states of oxidation, vanadium ores may resemble earthy red hematite or brown limonite; many ores occur in dark patches in bleached zones in colored sandstone; vanadium ores are often associated with certain elements; and radioactivity is a good guide. — ESL

08381 **Rosencwaig, A.** Double exchange and electron hopping in magnetite: Canadian Jour. Physics, v. 47, no. 21, p. 2309-2317, illus., 1969.

A Zener double-exchange model is formulated for magnetite and is used to describe the electron-hopping process. The main consequence of this model is that the electrons participating in the hopping process in any imperfect or nonstoichiometric (i.e. real) sample of magnetite can be regarded as being essentially localized to hopping within particular (Fe^{2+}-Fe^{3+}) octahedral cation pairs, and not as being in either some form of 3d conduction band or as participating in a nonlocalized electron-transfer process. Well-known results on the electrical conductivity, and new results with the Mössbauer effect in magnetite are then explained in terms of this pair-localized electron-hopping method. — Author's abstract

08344 **Rosenkrantz, A.; Pulvertaft, T. C. R.** Cretaceous-Tertiary stratigraphy and tectonics in northern West Greenland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 883-898, illus., table, 1969.

At the time of disintegration of Laurasia, block faulting, marine transgression, and basalt extrusion marked the geologic evolution of northern West Greenland. Downfaulting of the western seaboard probably began in Cretaceous, and great thicknesses of limnic arkose accumulated rapidly in a newly-formed depression, and coarse conglomerate was deposited at the foot of the fault scarps. In late Turonian time a marine transgression brought in a North American ammonite fauna; the sea later joined that covering Western Europe. Intercalations of tuff in Danian marine sediments are the first indication of volcanism which later led to extrusion of subaqueous basalts. There was intermittent faulting throughout Cretaceous and early Tertiary, but greatest movements occurred at the end of Maestrichtian, in mid-Danian, and after extrusion of basalts. The net result was a downthrow of several hundred meters on the seaward side of the faults. — *from* Authors' abstract

00502 **Roth, Charles Barron.** Ferrous-ferric ratio and cec changes with removal of ferruginous colloidal coatings from weathered micaceous vermiculites and soils [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 2985B, 1970.

Roth, H. Daniel. *See* Pierce, J. W. 00749

00931 **Rothwell, W. Thomas, Jr.** Late Neogene geologic events in common between the Caribbean and the Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 300-301, 1970.

08410 **Rowan, Lawrence C.** Structural geology of the Quad-Wyoming-Line Creeks area, Beartooth Mountains, Montana, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 1-18, illus., geol. map, 1969.

The rocks in the area consist mainly of banded migmatite, granitic gneisses, amphibolite, quartzite, and agmatite; small amounts of other types are also present. Quartzite outcrops continuously around the major folds, and agmatite is especially widespread in the axial zone of a major antiform. The Precambrian deformational history appears to be comprised of two phases of folding. During the first phase, south-southwest plunging isoclinal or nearly isoclinal folds formed by passive flow during metamorphism to at least upper amphibolite grade. Metamorphic differentiation of the sedimentary sequence occurred at this time. A second phase of deformation is shown by upright, nonisoclinal folds with south to southwest-plunging axes. Flexural flow was dominant, but passive flow was important in ductile layers. Granitization was synchronous with the second phase. — *from* Author's abstract

Rowekamp, Edward T. *See* Bradley, William C. 00597

00641 **Rowley, Peter D.** Geologic evolution of the southern Sevier Plateau, Utah [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 347-348, 1970.

00932 **Ruffin, James H.** Paleoecology (via palynology) of the upper Shaunavon, southwestern Saskatchewan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 301, 1970.

00615 **Ruhe, Robert V.; Prior, Jean C.** Pleistocene Lake Calvin, eastern Iowa: Geol. Soc. America Bull., v. 81, no. 3, p. 919-923, illus., tables, 1970.

The Pleistocene history of Lake Calvin is reinterpreted on the basis of logs of wells drilled into lake terraces and radiocarbon dates. Dated materials were from A horizon of basal soil of Wisconsin loess and from Iowan erosion surface in Iowa. The data imply that Lake Calvin terraces cannot be as old as Illinoian, as originally inferred. Rather, the information relates the terraces to episodes during cutting of the Iowan erosion surface in the Iowa and Cedar River drainage basins, in part concurrently with deposition of loess during an interval approximately 25,000-12,000 years B.P. — JHF

08230 **Rupp, A. W.** Turner Valley Formation of the Jumping Pound area, foothills southern Alberta, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 460-485, illus., 1969.

This oil-bearing Mississippian formation, about 350 feet thick, consists essentially of carbonate sediments, subdivided in ascending order into the Mt_5A, Mt_5B, Mt_3, Mt_2 and Mt_1. Pre-Jurassic erosion removed about 100 feet of the upper part in the Jumping Pound field, but at Jumping Pound West a full uneroded section is present. Major reservoir development is limited to clean marine carbonates with crinoids in varying abundance in the Mt_5A and some beds in Mt_1. Sediments in the upper three units are usually unfossiliferous microcrystalline dolomites, interpreted as products of a very shallow marine to supratidal environment. The formation had a complex penedepositional-post-depositional history. Briefly discussed are: chertification, dolomitization, post Mount Head pre-Nordegg unconformity, Nordegg deposition, deep Cretaceous burial, Laramide thrusting, solid hydrocarbon, fracturing, stylolites and spar calcite. — GDC

Russell, Ernest E. *See* Wilson, Charles W., Jr. 08412

Rutford, Robert H. *See* Kahil, Alain A. 00623

00944 **Ryall, Alan; Boucher, Gary.** Earthquakes and nuclear detonations: Science, v. 167, no. 3920, p. 1013, illus., 1970.

Issue is taken with the main finding of Emiliani and others (1969) that underground testing in Nevada has influenced earthquake activity over most of the conterminous western United States. Their statistical analysis reveals a departure from randomness in the times of occurrence of earthquakes in this region which is interpreted to mean that the time periods shortly after nuclear explosions contain an extraordinary number of earthquakes. It is suggested that the assumptions that earthquakes occur

randomly in time is invalid and that most of the earthquakes listed for this region belong to two categories, aftershock sequences and swarms of small events. This is shown to invalidate the analysis of Emiliani and others. — GV

Rylander, Don L. *See* Bullard, Fred M. 00875

Sakata, S. *See* Takeuchi, H. 00658

Sarich, V. M. *See* Wilson, A. C. 08375

Sarpi, Ernesto. *See* Helwig, James. 08323

Sasaki, A. *See* Kajiwara, Y. 08239

00562 **Saucier, Roger T.; Fleetwood, Arthur R.** Origin and chronologic significance of late Quaternary terraces, Ouachita River, Arkansas and Louisiana: Geol. Soc. America Bull., v. 81, no. 3, p. 869-890, illus., geol. map, tables, 1970.

The Quaternary alluvial deposits along the Ouachita River Valley can be divided by depositional environment into five fluvial terraces, three composing the Deweyville terrace sequence. Disregarding the oldest Montgomery terrace the chronological sequence includes: (1) deposition of the Prairie terrace formation during the Sangamon Interglacial Stage; (2) primary valley degradation and deep stream entrenchment during waxing Early Wisconsin glaciation; (3) alluviation during waning Early Wisconsin glaciation; (4) secondary valley degradation and moderate entrenchment during waxing Late Wisconsin glaciation; (5) alluviation and valley aggradation during waning Late Wisconsin glaciation, continuing into the Holocene. — *from* Authors' abstract

08196 **Saunders, Donald F.** Airborne sensing as an oil reconnaissance tool, *in* Unconventional methods in exploration for petroleum and natural gas (W. B. Heroy, editor) — Southern Methodist Univ., Inst. Study of Earth and Man, Symposium [1968]: Dallas, Tex., Southern Methodist Univ., p. 105-125, illus., 1969.

Recent less conventional developments in remote sensing include: use of special new films and filters and infrared scanners to provide supplementary data for improved photogeologic interpretations, and geologic inferences from fracture-density patterns interpreted from aerial photo-lineament analysis. Future unconventional methods of petroleum reconnaissance are predicted to include remote identification or analyses of surface or near-surface materials, using aerial gamma-ray spectrometers, airborne spectral infrared scanners, aerial optical-correlation spectrometers, and remote measurement of electrical properties of soils. These should provide supplementary data for photogeologic and geomorphologic structural interpretation and may provide a new possible approach to 'direct' oil finding. — *from* Author's abstract

00949 **Savin, Samuel M.; Epstein, Samuel.** The oxygen and hydrogen isotope geochemistry of clay minerals: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 25-42, illus., tables, 1970.

Oxygen and hydrogen isotope analyses have been made on a variety of clay minerals of sedimentary and diagenetic origins. The interlayer water of clay minerals was found to exchange rapidly with atmospheric water, making its removal possible prior to isotopic analysis. A table is given of approximate fractionation factors for clay mineral-water systems at sedimentary temperatures, inferred from isotopic compositions of natural samples. Results suggest that fractionation factors are equilibrium ones and that kaolinite forms in isotopic equilibrium with its environment. It is suggested that deviations of the isotopic composition of montmorillonites result from isotopic exchange at slightly elevated temperatures. There was no clearly demonstrable case of clay minerals undergoing isotopic re-equilibration at sedimentary temperatures. — GV

00974 **Savin, Samuel M.; Epstein, Samuel.** The oxygen and hydrogen isotope geochemistry of ocean sediments and shales: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 43-63, illus., tables, 1970.

Oxygen and hydrogen isotope analyses on the carbonate-free fractions of 27 ocean core samples from the Atlantic, Pacific, and Indian Oceans yielded δ 0-18 values ranging from +11.5 to +28.5 per mil, and δD values from -5.5 to -8.7 percent relative to SMOW. In terms of the isotopic record, it is impossible to distinguish between marine and non-marine shales. On the basis of chemical analyses, the cores were divided into two groups, those with Fe + Mn between 7 and 15 wt percent and those with Fe + Mn between 2 and 5 wt percent; characteristics of each are discussed. From material balance calculations, it is suggested that the effect of weathering and sedimentary processes has been to deplete the hydrosphere of 0-18 by about 3 per mil and to enrich the hydrosphere in deuterium by about 0.03 percent during the Earth's history. — GV

Sayre, J. G. *See* Davies, Tudor T. 00692

00580 **Schaeffer, Bobb; Mangus, Marlyn.** *Synorichthys* sp. (Palaeonisciformes) and the Chinle-Dockum and Newark (Upper Triassic) fish faunas: Jour. Paleontology, v. 44, no. 1, p. 17-22, illus., table, 1970.

The genus *Synorichthys* Schaeffer (1967), previously reported from the Chinle Formation (Colorado-Utah) and the ?Dockum Group (Texas), has recently been found in Lockatong Formation of the Newark Group at North Bergen, New Jersey. This discovery has further emphasized the resemblance between the Upper Triassic fish faunas in the eastern and western United States. The composition of the two faunas is compared. — Authors' abstract

Scharon, H. LeRoy. *See* Ehrlich, Marvin. 08299

08379 **Scheidegger, A. E.** Stability conditions for displacement processes in porous media: Canadian Jour. Physics, v. 47, no. 2, p. 209-214, illus., 1969.

A general discussion is presented of the possibility of the development of a steady state in frontal displacement processes with and without "fingers" in porous media. It is shown that, based on the theories available to date, such displacement processes always appear to be unstable; i.e. the "length" of the "front" over which the transition from the displaced fluid to the displacing one occurs, grows indefinitely. — Author's abstract

Schmidt-Bleck, F. *See* Laul, J. C. 00955

08207 **Schneer, Cecil J.** Introduction, *in* Toward a history of geology (C. J. Schneer, editor) — New Hampshire Inter-Disciplinary Conf. History of Geology, 1967, Proc.: Cambridge, Mass., and London, M.I.T. Press, p. 1-18, 1969.

Problems of the earth that stirred man's imagination for more than 3,000 years are reviewed. Questions of its nature, composition and size, source of confusion and change seen, and how to reconcile them with cncepts of origin, were raised in ancient times. They formed the basis for a progression of ideas about the origins of the earth, and led to the development of a classical orderly science which culminated in Darwin's *Origin of the species*. The men and methods that provided evidence and ideas for the formation of an extraordinarily complex science, topics taken up in detail by contributors to this volume, studies which involve attempts to ally natural history and the Bible, and conflicting views of the vulcanists and neptunists are discussed. — GDC

08236 **Schneer, Cecil J.** (editor). Toward a history of geology — Proceedings of the New Hampshire Inter-Disciplinary Conference on the History of Geology, 1967: Cambridge, Mass., and London, M.I.T. Press, 469 p., illus., 1969.

Twenty-six papers by scholars in the fields of geology and history of science are presented to recreate the world view available to young Charles Darwin. Papers by Baumgartel, Greene, Hedberg, Sherwood and White, and the Introduction, are cited separately. Others review: the campaign of St. Hilaire and Cuvier for paleontological evolution; mineral classification; Lyell's uniformitarianism; de Maillet's ultra-neptunian earth; Jorden's *Fermentation of metals*; Hutton's dynamic earth; William Smith's

life and work; 18th century geological work; Dr. Scheuchzer and *Homo diluvii testis*; Werner's *Kurze Klassifikation*; diluvianism and its critics; geological atlas of Guettard, Lavoissier and Monnet; Lyell on Etna, and antiquity of the earth; porcelain and plutonism; Nicolas Desmaret; early geological sciences in U.S.S.R.; changing ideas on moving shorelines; and intellectual background to Lyell's *Principles of geology*. — *GDC*

00642 **Schneider, Gary B.** Cenozoic stratigraphy of the Madison Bluffs area, Gallatin County, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 348, 1970.

Schnetzler, C. C. *See* Philpotts, John A. 08201

Schnoes, H. K. *See* Simoneit, B. R. 00943

00545 **Schopf, J. William.** Electron microscopy of organically preserved Precambrian microorganisms: Jour. Paleontology, v. 44, no. 1, p. 1-6, illus., 1970.

Organically preserved microorganisms of the Late Precambrian, Bitter Springs Formation of Australia were studied by transmission and scanning electron microscopy. Preliminary results indicate potentially significant evolutionary and biostratigraphic ultrastructures are preserved in Precambrian fossils. These ultrastructures may distinguish ancient and modern organisms which appear similar under light microscopy. — JWH

00555 **Schopf, Thomas J. M.; Simpson, Dale R.** A method for finding conodonts in large, nearly barren samples: Jour. Paleontology, v. 44, no. 1, p. 164-165, 1970.

Phosphatic fossils, such as conodonts, will be surrounded by a white spot on a blue filter paper where an ammonium molybdophosphate has formed if the filter paper has been previously soaked in a blue, acid solution of ammonium molybdate and stannous chloride. Searching for rare fossils with this technique is more thorough, less time consuming, easier on the eyes, and less fatiguing than customary procedures. The new method causes slight, but not serious etching of the fossil surface. — Authors' abstract

Schultz, C. Bertrand. *See* Vondra, Carl F. 08386

00781 **Schultze, Hans-Peter.** Folded teeth and the monophyletic origin of tetrapods: Am. Mus. Novitates, no. 2408, 10 p., illus., 1970.

Tooth form has become an important indicator of phyletic relationships within Mammalia. Among crossopterygians and lower tetrapods there are groups that have teeth of peculiar internal structure, involving an infolding of the orthodentine. The dendrodont tooth is a highly advanced type of folded tooth peculiar to Porolepiformes, and supports a common ancestry for the group. The eusthenodont tooth is a moderately advanced type, occurring only in three genera, and may not indicate common ancestry. The polyplocodont tooth is a primitive type, occurring in many Osteolepiformes and some early tetrapods. For the specialized tooth structure of Ichthyosauria and Varanoidea, a suitable ancestral type could not be found. Divided teeth, a specialization within tetrapods, occur in nearly all Recent Amphibia. These facts suggest that Urodela, Anura, and Apoda have had a common ancestry. — ESL

Schulz, Warner. *See* Dexter, William A. 08394

Schumann, Herbert H. *See* Eaton, Gordon P. 00609

Sclater, J. G. *See* Francheteau, Jean. 00587

Scrudato, Ronald J. *See* Neff, James R. 00743

00761 **Scrudato, Ronald J.; Bond, Thomas A.** Cretaceous-Tertiary boundary of east-central Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 240, 1970.

08387 **Seiglie, George A.** Observaciones sobre el género de foraminíferos *Buliminoides* Cushman [with English abs.]: Rev. Española Micropaleontología, v. 1, no. 3, p. 327-333, illus., 1969.

More than 100 living specimens of four species of *Buliminoides* have been studied to confirm the taxonomic significance of the radially striated aperture; the genus is redescribed on this basis. Specimens of *B. parallela, B. milletti, B. stainforthi, B. curta* were dredged from two stations on the Cabo Rojo platform southeast of Puerto Rico. Age range of these species is Oligocene to Holocene; other species range from Late Cretaceous. *Buliminoides* lives in shallow-water reefs and reproduces by plastogamy, during which the aperture becomes enlarged and the septa are resorbed. The genus is compared with *Glabratella*, which has similar habitat and reproduction, and with *Buliminella*, which lives in muddy substrate in deeper water on the platform and in which plastogamy has not been observed. — VMJ

08314 **Seilacher, A.; Crimes, T. P.** "European" species of trilobite burrows in eastern Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 145-148, illus., 1969.

Close similarity in trace fossils, facies, and lithologic sequence of the Upper Cambrian and lower Ordovician in eastern Newfoundland, Wales, and northern Spain indicates that these areas were originally in closer proximity. However, the particular kinds of trilobite burrows (Cruziana) that are present in Newfoundland, as well as in many parts of the Old World, are unknown in rocks of equivalent age and facies in mainland North America. — Authors' abstract

08409 **Semenov, Yevgeniy Ivanovich.** Mineralogiya shchelochnogo massiva Ilimausak (yuzhnaya Grenlandiya) [Mineralogy of the Ilímaussaq alkalic massif (southern Greenland)]: Moscow, Izdatel. "Nauka," 165 p., illus., 1969.

A brief account of the principal rock types forming the layered Precambrian massif is followed by the results of a systematic study of the major and accessory mineral species and varieties. Some 130 minerals have been reported in the literature; full chemical analyses have been given for some, and the validity of 57 has been confirmed. Numerous new analyses are here reported, together with comparative data for minerals of the alkalic massifs of the Kola Peninsula (USSR). X-ray and infrared data are also included. The distribution of elements and paragenetic associations are discussed, on the basis of which the minerals are classed into ten groups and the mineralization sequence outlined. — MS

Sergeant, Richard E. *See* Wigley, Perry B. 00976

Shaw, Denis M. *See* Evans, Bernard W. 08277

08227 **Shawa, Monzer S.** Sedimentary history of the Gilwood sandstone (Devonian), Utikuma Lake area, Alberta, Canada, *in* Alberta Soc. Petroleum Geologists Calgary Core Conf. 1969: Bull. Canadian Petroleum Geology, v. 17, no. 4, p. 392-409, illus., table, 1969.

This member of the Watt Mountain Shale, deposited on the flank of the Peace River Arch, is an excellent trap for hydrocarbons in the Nipisi oil field. From study of 75 cores and 54 thin sections, its composition is about 57 percent quartz, 16 percent microcline, minor plagioclase and biotite, and 15 percent cementing material; its average porosity is 10 percent. Sedimentary structures include trough and tabular crossbedding, rip-up shale clasts, and laminations. Grain size distribution is largely unimodal, but in certain places, bimodal. Paleocurrent analyses, subrounded sand texture, and geometry suggest at least a second cycle deltaic deposit derived from the west and modified by southwest-flowing long shore currents. Depositional environments were fluvial, transitional, and near-shore marine, each characterized by several sedimentary structures summarized in a table. — GDC

Shelton, John W. *See* Matalucci, Rudolph V. 00909

Sherard, J. L. *See* Waggoner, E. B. 08300

00561 **Sheridan, Michael F.** Fumarolic mounds and ridges of the Bishop Tuff, California: Geol. Soc. America Bull., v. 81, no. 3, p. 851-867, illus., table, 1970.

Fumarolic mounds up to 60 m in diameter and ridges up to 600 m long are resistant features that stand 0.5 to 15 m above the general surface of the tuff. Fumaroles were formed in greatest numbers where crystallization within the sheet was intense and are absent where the sheet was thick, densely welded, but remained vitric. Early, pre-fumarolic, conjugate joint sets controlled the distribution of the mounds and ridges. The general mineralogy of fumarolic areas — tridymite, cristobalite, and alkali feldspar — is similar to that of the vapor-phase zone, but contains in addition in the inner alteration zone hydrobiotite and marialite. The chemical composition also is similar to that of the vapor-phase zone. Near fumarolic vents there is a significant decrease in SiO_2 and an increase in Al_2O_3, K_2O, and H_2O. — RAL

08305 **Sherwood, Morgan B.** Genesis, evolution, and geology in America before Darwin — The Dana-Lewis controversy, 1856-1857, *in* Toward a history of geology (C. J. Schneer, editor) — New Hampshire Inter-Disciplinary Conf. History of Geology, 1967, Proc.: Cambridge, Mass., and London, M.I.T. Press, p. 305-316, 1969.

In *The six days of creation* (Tayler Lewis, 1855) were many sharp criticisms of science and scientists, especially geologists. Its author, a classicist but not theologian, was impatient with evidence in scientific language and theory inadequate for biblical interpretation. Personally affronted James Dwight Dana, celebrated mineralogist-geologist, stated his case against Lewis in four articles entitled "Science and the Bible" (Bibliotheca Sacra, v. 13 and 14, 1856; 1857). Lewis' rejoinder "The Bible and Science" (1856) made it clear that to him Scripture, not science deserved precedence. The main source of friction was a matter of intellectual jurisdiction in the interpretation of the Bible. Brief biographical sketches mention Dana's nervous breakdown soon after the controversy. Lewis did recognize a development theory of species from species as a possible step after creation. Dana gradually became an evolutionist, but a qualified Darwinist. — GDC

Shimer, John A. *See* Stewart, John C. 08218

00792 **Shrock, Robert R.** Memorial to Edgar Roscoe Cumings (1874-1967): Geol. Soc. America Proc. 1967, p. 177-183, portrait, 1970.

08287 **Shurbet, D. H.** Increased seismicity in Texas: Texas Jour. Sci., v. 21, no. 1, p. 37-41, illus., 1969.

The Texas Technological College Seismological Observatory has recorded recently increased seismic activity in the regions near Amarillo and Kermit, Texas. It is suggested that the increased activity is related to the formation of Lake Meredith near Amarillo and to petroleum production and water-flood projects near Kermit. Therefore, detailed study of these areas may be useful in the effort to develop a basis for earthquake prediction. — Author's abstract

00643 **Shurr, George W.** Unconformable relationships between the Pierre Shale and Niobrara Formation in central South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 348-349, 1970.

Simmons, Gene. *See* Horai, Ki-iti. 00584

00799 **Simon, Jack A.** Memorial to John Albert Harrison (1916-1967): Geol. Soc. America Proc. 1967, p. 215-217, portrait, 1970.

00948 **Simon, Ruth B.** Denver earthquakes: Science, v. 167, no. 3924, p. 1519, 1970.

In reply to Karp's remarks, it is noted that no seismograph stations of sufficient sensitivity to record very small earthquakes existed in the Denver area prior to January 1962, four months before the Denver earthquake was recorded, that the smallest earthquakes have always occurred near the wellhead on the Rocky Mountain Arsenal grounds, and that shocks of magnitudes from 2.5 to > 5.0 have been observed ever since the termination of fluid injection in 1966. It is concluded that tectonic

strains under northeast Denver are more likely to be the cause of the earthquakes now as in the past, than fluid pressure which has not increased, but which has been actually decreasing over the last three years. — GV

00943 **Simoneit, B. R.; Schnoes, H. K.; Haug, P.; Burlingame, A. L.** Nitrogenous compounds of the Colorado Green River Formation oil shale — A preliminary analysis by mass spectrometry: Nature, v. 226, no. 5240, p. 75-76, illus., table, 1970.

Results are presented of a preliminary analysis of nitrogen compounds directly extractable from the Green River Formation. In general, the major constituents of shale oil are of a more dehydrogenated and nonbasic nature than the basic extracts of the shale. These direct extracts contain greater proportions of more saturated ring systems and smaller amounts of the nonbasic and more volatible constituents. Further oxygenated nitrogen compounds are found in the extracts. They have not been reported as significantly present in shale oil, probably because they would eliminate water during retorting. — DBV

Simpson, Dale R. *See* Schopf, Thomas J. M. 00555

08341 **Skehan, James W.** Tectonic framework of southern New England and eastern New York, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 793-814, illus., table, 1969.

Anticlinorial massifs are developed in western New England and southeastern New York at the boundary of the eugeosynclinal sequence on the east and the miogeosynclinal sequence on the west, the latter overlain by the Taconic allochthon. A N-S-trending linear series of domes, east and west of the Connecticut Valley, lies between the Merrimack synclinorium and the western massifs. The eastern part is composed of a series of imbricate fault blocks bounded by west-dipping thrusts. An eastern series of basins, chiefly of Paleozoic rocks, is present on Precambrian basement. Analysis of data from the Wachusett-Marlborough fault block indicates that mapping of joints may be a method for extrapolating covered faults of regional significance. Skehan theorizes that the zone of batholiths of the synclinorium and fringing domes composed a Paleozoic rise whose expansion produced syn- to postorogenic gravity slides and thrusts. — VSN

Slaughter, Bob H. *See* Menzer, Fred J. 00911

00616 **Slaughter, M.; Hamil, M.** Model for deposition of volcanic ash and resulting bentonite: Geol. Soc. America Bull., v. 81, no. 3, p. 961-968, illus., 1970.

A "mushroom cloud" model describes the depositional features of ash from highly explosive volcanoes. The model is represented as an expanding disk-shaped cloud from which deposition occurs. It contains an original particle-sized distribution, allows areal expansion of the distribution in a turbulent atmosphere, and aggregation of particles due to water and static electricity in the volcanic cloud. The model yields elongate tongue-shaped deposits whose dimensions are a function mainly of wind velocity and cloud height, but are also affected by particle aggregation. Histograms of particle sizes from several positions on an ash bed show change of modal sizes and skewness in hypothetical ash beds. Model distributions show close affinities to particle sizes in real ash beds. — *from* Author's abstract

08360 **Slaughter, M.; Kane, W. T.** The crystal structure of a disordered epistilbite [with German abs.]: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 68-87, illus., tables, 1969.

The zeolite epistilbite is monoclinic, a=9.04, b=17.73, c=9.08 A, β=111°50′, space group $C2$. The structure is built of 5-membered rings of Si tetrahedra. Continuous 8-membered-ring channels are intersected at right angles by staggered, narrow 10-membered-ring channels. Ca ions occupy channel intersections and are surrounded by five water molecules and three framework oxygen atoms to form a distorted square antiprism. Calcium ions are disordered on two sites in C2/m, the disordering

apparently occurring as more or less random shifts of rows of calcium ions parallel to [101]. Aluminum substitution for silicon correlates closely with Ca positions. — Authors' abstract

Slaughter, M. *See* Leimer, H. W. 08361

Smith, Charles W. *See* Higgins, Michael W. 00714

00533 **Smith, Geoffrey Wayne.** Surficial geology of the Shuswap River drainage, British Columbia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3244B-3245B, 1970.

00945 **Smith, J. W.; Kaplan, I. R.** Endogenous carbon in carbonaceous meteorites: Science, v. 167, no. 3923, p. 1367-1370, illus., tables, 1970.

Seven carbonaceous chondrites have been analyzed for soluble organic compounds, carbonate, and residual carbon. Carbon-13/carbon-12 isotopic measurements on these fractions gave the following values relative to a marine carbonate standard: carbonate +40 to +70 per mil; residual carbon, -15 to -17 per mil; soluble organic material, -17 to -27 per mil, with one value of -5.5 per mil. These values are interpreted to indicate that carbonate, residual carbon, and part of the extractable organic material are endogenous to these meteorites. — Authors' abstract

Smith, Lester B., Jr. *See* Benham, Steven R. 00672

Smith, Stewart W. *See* Anderson, Don L. 00811

08248 **Smith, Wilbur H.; John, Edward C.** More jobs for geology spur better mapping methods at Bingham Canyon: Mining Eng., v. 21, no. 9, p. 93-94, illus., 1969.

At Bingham Canyon open-pit copper mine, Utah, demand for geology has grown and diversified so rapidly that it has caused a revolution in mapping techniques. The most significant changes have been in preparation of base maps and in computer application of collected data. A photogrammetric map is prepared semiannually and updated continuously. Field mapping procedures and problems are described. Currently emphasis is on sulfide mineral distribution and reconnaissance of alteration and slope stability. For accuracy nearly horizontal photographs are used to give maximum outcrop. A continuing program of geology is essential as it has been shown that concentrate grade and copper recovery are directly related to distribution and mix of the sulfide minerals. Structures affecting slope stability are mapped in detail in unstable areas. — ESL

00644 **Smouse, DeForrest.** Inclusions within the lavas of Crater 160, San Francisco volcanic field, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 349, 1970.

00946 **Snowden, J. O.** The Sangamon Soil in lower Mississippi Valley loess [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 240-241, 1970.

Snyder, Carrie B. *See* Chow, Tsaihwa J. 08206

So, C. L. *See* Pierce, J. W. 00749

00797 **Socolow, Arthur A.** Memorial to James Lindsay Dyson (1912-1967): Geol. Soc. America Proc. 1967, p. 207-209, portrait, 1970.

Sowers, George M. *See* Gallagher, John J. 00897

00967 **Spector, Allan; Hornal, Robert W.** Gravity studies over three evaporite piercement domes in the Canadian Arctic: Geophysics, v. 35, no. 1, p. 57-65, illus., table, 1970.

Reconnaissance gravity surveys over three evaporite piercement domes in the Canadian Arctic Islands have been interpreted. Each dome was considered as a right-

vertical cylinder divided into two homogeneous regions, a high density anhydrite zone overlying a low density gypsum and (or) salt rock zone. The cylinder is surrounded by a sedimentary sequence which has a uniform density. Interpretation involved a least-sum-of-squares approach to estimate thickness of the anhydrite and gypsum-rock salt zones. The three sets of estimates gave a range of 200 to 550 m for the anhydrite thickness and of 700 to 5500 m for the vertical extent of domes. In each case, depths were less than expected on the basis of estimates from seismic and geologic data. Possible explanations for this are offered. — *from* Authors' abstract

Spivak, A. *See* McCulloch, R. C. 08272

00645 **Stach, R. L.; Mowatt, T. C.** Investigation of some basement rocks from South Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 349, 1970.

00646 **Starmer, Robert J.; Koucky, Frank L.** Post-metamorphic deformation of the Precambrian core, Bighorn Mountains, Wyoming [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 350, 1970.

00762 **Steele, Kenneth F.** Chemical differentiation of a Triassic(?) diabase dike, Pageland, South Carolina [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 241, 1970.

00547 **Stehli, Francis G.; Grant, Richard E.** Permian brachiopods from Huehuetenango, Guatemala: Jour. Paleontology, v. 44, no. 1, p. 23-36, illus., 1970.

The Chochal Limestone in the Department of Huehuetenango, Guatemala, has yielded a silicified fauna including fusulinids, sponges, corals, gastropods, ammonoids, trilobites and seventeen genera of brachiopods. The enclosing rock is dark calcilutite, strongly folded and faulted, but a sizeable sample of well preserved and only slightly distorted specimens was recovered. The brachiopod fauna contains Tethyan genera interpreted to have lived at relatively low latitudes during the Permian. Correlation of the fauna is with the Leonard Series of the southwestern United States. New species are: *Hercosestria notialis, Rugatia andersoni, Echinauris huehuetenanguensis, Composita hapsida.* — Authors' abstract

Steinbrugge, K. V. *See* Cloud, W. K. 00858

00647 **Stensrud, Howard L.; Gresens, Randall L.** Trace element partioning between coexisting muscovite and biotite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 350-351, 1970.

00763 **Stephenson, Robert A.** Application of the critical point theorem to topographic surfaces [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 242, 1970.

Stevens, Margaret S. *See* Lundelius, Ernest L. 00581

00818 **Stevenson, F. J.; Cheng, C. N.** Amino acids in sediments — Recovery by acid hydrolysis and quantitative estimation by a colorimetric procedure: Geochim. et Cosmochim. Acta, v. 34, no. 1, p. 77-88, illus., tables, 1970.

Conventional hydrolysis of argillaceous sediments with 6 N HCl gave low recoveries of amino acids; yields were increased considerably by prior destruction of clay with HF. Experiments with dried amino acid-clay complexes indicated that proteinaceous substances "keyed" into hexagonal holes on interlamellar surfaces of expanding-lattice clays may resist extraction with boiling 6 N HCl. A convenient and reliable colorimetric procedure was developed for the determination of amino acid-N in sediments. The technique is described in detail along with its application. — Authors' abstract

08218 **Stewart, John C.; Shimer, John A.; Nehru, C. E.** Studies of our Earth — Laboratory exercises in earth science: Minneapolis, Minn., Burgess Publishing Co., 114 p., illus., tables, 1968 [1969].

This laboratory manual designed for a freshman or sophomore college course for nonscience majors presupposes little in the way of previous experience in science; in practice it is intended to complement a general earth science course that follows one year of a general college science course. — MCM

00979 **Stone, William J.** Source and significance of cobbles in the Chadron Formation (Oligocene) of North Dakota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 351, 1970.

Stout, Thompson M. *See* Vondra, Carl F. 08386

00829 **Strahler, Arthur N.** Introduction to physical geography (2d edition): New York and London, John Wiley and Sons, 457 p., illus., 1970; originally published 1965.

The basic premise of this book is that the aim of physical geography is an understanding of man's physical environment; therefore, considerable natural science of the Earth's crust and interior, oceans and their basins, upper and outer atmosphere, and planetary space are omitted from this abbreviated text. New material in this edition includes a survey of the Earth's atmosphere as a layered structure and heating and cooling of the atmosphere as viewed from the standpoint of a global radiation budget, colored maps, soil profiles and classification, and landform classification. Chapters of geologic interest are those on landforms; Earth's crust; runoff and ground water; coastal plains, horizontal strata, domes; folds, faults, fault blocks; and crystalline masses and volcanic forms. — MCM

08366 **Straley, H. W., 3d.** Geographical distribution of Virginia earthquakes: Elisha Mitchell Sci. Soc. Jour., v. 85, no. 4, p. 152-156, illus., table, 1969.

According to a list of Virginia earthquakes (MacCarthy, 1964) and a map of epicentral sites, there are four areas of concentrations: near mouth of Chesapeake Bay; Coastal Plain and Piedmont areas; lower Shenandoah Valley; and upper valleys of the Holston and New Rivers, extending to Bristol. Near the coast, ocean-floor spreading might be driving an oceanic segment beneath the continent. In the Coastal Plain-Piedmont areas and the Great Valley, separated by an area in which thrust faulting of the southwest gives way to folding of the northeast, there also may be residual stresses of Appalachian orogeny. Coincidence of known faults with lines connecting epicentral sites, carried through Tennessee to the Mississippi Valley area, may be tectonically significant in the subsurface. Minor isostatic adjustments following melting of Pleistocene ice should be considered also. — GDC

Strangway, D. W. *See* Goldstein, Myron A. 08205

Stuart, A. *See* Hartshorne, N. H. 08217

08353 **Supp, Carl W. A.** Maryland State Roads Commission versus Champion Brick Company — Condemnation of clay-bearing lands, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 95-112, illus., tables, 1969.

The brick-company owner of urban land condemned for highway-interchange construction in Maryland rejected settlement of 178,000 dollars, claiming that diminishment of available clay deposits to a 5-year supply reduced his plant value by 3,500,000 dollars. It was contended that remaining reserves would outlast the plant's residual life of 23 years. Pre-trial preparations included research on local Coastal Plain geology, clay technology, and brick-manufacturing processes; detailed subsurface exploration; laboratory testing of 500 samples for suitability of remaining deposits by correlation with raw materials in use; quantification of depletion rate and volume of recoverable clay; and, as visual exhibits for a lay jury, annotated airphotos, geologic sections and a 3-dimensional model. Accumulated data, substantiating assurance of at least 21 years of production, also tend to challenge validity of 3 currently recognized formations in the Potomac Group in the Baltimore area. — GDC

Swanson, Mary. *See* Emiliani, Cesare. 00813

00764 **Sweet, Walter C.; Bergström, Stig M.** Stratigraphic significance of conodonts from the Lexington Limestone and Kope Formation in the Cincinnati region [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 242-243, 1970.

00765 **Swinchatt, Jonathan P.** Mississippian carbonate facies in northeastern Kentucky — Tidal flat-island complexes on a terrigenous-carbonate shelf [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 243, 1970.

00563 **Switzer, George; Melson, William G.; Thompson Geoffrey.** Garnet from the Mid-Atlantic Ridge near 43° N. latitude: Geol. Soc. America Bull., v. 81, no. 3, p. 895-897, table, 1970.

Two andradite garnets are described from the Mid-Atlantic Ridge near 43° N., 27° W., depth 2200 to 2500 m. One is nearly pure andradite (topazolite). The other is titanium andradite (melanite) with 9.3 percent TiO_2. Both are in a diopside-chlorite matrix associated with serpentinized peridotite. This appears to be the second known occurrence of melanite in serpentinized peridotite, the other being in San Benito County, California. — Authors' abstract

Taft, W. H. *See* McLester, M. E. 00787

Takagi, Robert S. *See* Berry, William B. N. 00549

00658 **Takeuchi, H.; Sakata, S.** Convection in a mantle with variable viscosity: Jour. Geophys. Research, v. 75, no. 5, p. 921-927, illus., 1970.

Studies are made on typical features of convection current in a thin viscous layer on a deep layer of high viscosity. Streamlines are concentrated but not closed in the upper thin layer; horizontal velocity is one sign in the upper layer and the other sign in the lower. Horizontal mass flux in the upper layer is balanced by the counter-horizontal mass flux in the lower layer. Aspect ratio of critical perturbation, referred to the whole layer thickness, is not so different from that in the homogeneous layer case. Aspect ratio, referred to thickness of the thin upper layer in which the current is concentrated, is large. Results give a theoretical justification for existence of very flat convection cells in the mantle. The free surface of the fluid is low (high) where temperature is lower (higher) and vertical velocity is downward (upward). This may explain formations of Pacific guyots. A quantitative check of this idea and estimations of physical parameters involved are made. — *from* Author's abstract

Taylor, R. E. *See* Bucha, V. 00952

Ternes, Elizabeth B. *See* Tourtelot, Harry A. 00648

Textoris, Daniel A. *See* Falls, Darryl L. 00699

Thayer, Paul A. *See* Justus, Philip S. 00726

Theodore, Ted G. *See* Wrucke, Chester T. 00590

00558 **Thiruvathukal, John V.; Berg, Joseph W., Jr.; Henrichs, Donald F.** Regional gravity of Oregon: Geol. Soc. America Bull., v. 81, no. 3, p. 725-738, illus., 1970.

A complete Bouguer gravity anomaly map, superimposed on a regional geologic map of Oregon, is constructed from about 4000 gravity measurements. The data are filtered to obtain approximations of crustal thicknesses, which range from 20km near the shore to more than 45km in southeastern Oregon. The Coast and Cascade Ranges have no significant roots. The average free-air gravity anomaly for the state is near zero, suggesting that the state as a whole is in mass equilibrium with a standard earth column. — AG

00560 **Thom, Bruce G.** Carolina Bays in Horry and Marion Counties, South Carolina: Geol. Soc. America Bull., v. 81, no. 3, p. 783-813, illus., tables, 1970.

Carolina bays are exceptionally well developed in Horry and Marion Counties. Depositional surfaces of coastal and fluvial origin have been mapped; bays occur on 7 sand-rich surfaces, all pre-Recent in age. The majority of bays are underlain by sand cemented with humate which forms an impermeable layer allowing development of shallow, wet depressions in sandy terrain. Other bay types are located in depressions initiated by dune deflation or damming by fluvial deposition. Drilling in bays shows no evidence of solution and subsidence in spite of carbonate-rich strata in the subsurface and some very localized sinkholes. It is postulated that bays in this area developed from shallow lakes during mid- to late-Wisconsin. Parabolic dunes indicate SW and WSW winds; a hydrodynamic system may have led to elongated shapes and sand rims. — *from* Author's abstract

00767 **Thomas, William A.** Paleozoic stratigraphy of Mississippi [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 244, 1970.

Thompson Geoffrey. *See* Switzer, George. 00563

00853 **Thompson, Geoffrey; Bankston, Donald C.; Pasley, Susan M.** Trace element data for U.S.G.S. reference silicate rocks: Chem. Geology, v. 5, no. 3, p. 215-221, tables, 1970.

The new U.S.G.S. reference rocks G-2, GSP-1, AGV-1, BCR-1, DTS-1, and PCC-1, together with the standard rocks W-1 and G-1 have been analyzed by emission spectrometric methods. Data for the trace elements Ag, B, Ba, Bi, Cd, Co, Cr, Cu, Ga, Li, Mo, Ni, Pb, Rb, Sn, Sr, V, Y, Zn, and Zr found by this technique have been tabulated, together with some previously reported results obtained by other techniques for these elements. — Authors' summary

00534 **Thompson, Thomas Dick, 3d.** Adsorption of purines, pyrimidines and nucleosides on montmorillonites and illites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3245B, 1970.

Thorndike, Edward M. *See* Eittreim, Stephen. 08212

08369 **Thorpe, Ralph.** Metallogenesis and exploration in the Northwest Territories, *in* Guidelines to prospecting — A symposium: Canadian Mining Jour., v. 90, no. 4, p. 78-80, 99-102, 1969.

Current exploration is directed toward copper, nickel, uranium, and silver, and gold properties are being re-examined. Three structural provinces (the Bear, Slave, and Churchill) of the Canadian Shield are included in the Northwest Territories. Metallogenesis of, and exploration for, gold, silver, uranium, copper, lead and zinc, nickel, pegmatites (lithium, beryllium, columbium-tantalum, tin), molybdenum, and tungsten are described. — ESL

00535 **Thorstenson, Donald Carl.** Equilibrium distribution of small organic molecules in natural waters [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3245B, 1970.

08290 **Thurmond, John T.** Notes on mosasaurs from Texas: Texas Jour. Sci., v. 21, no. 1, p. 69-80, illus., table, 1969.

Nine taxa of mosasaurs from the Gulfian of Texas are described. Three species appear to be of some value as index fossils: *Globidena alabamaensis* Gilmore and *Platecarpus somenensis* Thevenin for the Campanian, and *Platecarpus coryphaeus* (Cope) for the Coniacan. A fragment from the Eagle Ford (Turonian) is the earliest reported North American mosasaur. — Author's abstract

00768 **Tidball, R. R.; Connor, J. J.** Distribution of elements in a black shale parent and its derivative soil, western Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 244-245, 1970.

00933 **Tieh, Thomas T.; Cook, Earl F.** Carbonatitic dikes in ignimbrites of Lincoln County, Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 301-302, 1970.

00503 **Tiwari, Suresh Chandra.** Source and behavior of potassium in Cecil soils [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 2985B-2986B, 1970.

00962 **Tixier, M. P.; Alger, R. P.** Log evaluation of nonmetallic mineral deposits: Geophysics, v. 35, no. 1, p. 124-142, illus., tables, 1970.

Well logs can be used to locate and evaluate deposits of various commercially important minerals, if the mineral of interest represents a significant fraction of the formation bulk volume and exhibits characterizing properties measurable by logs. For evaluation of sulfur deposits, either density or sonic logs provide good resolution when compared with porosity computed from neutron or resistivity logs. Trona beds are identified by a sonic reading of about 65 microsec per ft, neutron porosity index of 40 percent, low natural radioactivity, and pronounced hole enlargement. Gamma-ray logs provide important information in the location, identification, and evaluation of potash mineral deposits. Coal beds are characterized by high resistivities, and by high apparent porosities on sonic, neutron, and density logs. Density logs are particularly suited for evaluation of yield from oil shales. — GV

Tocher, D. *See* Cloud, W. K. 00858

00784 **Todd, Ruth.** Recent literature on the Foraminifera: Cushman Found. Foram. Research Contr., v. 21, pt. 1, p. 40-46, 1970.

Ninety-seven items are cited and annotated; coverage is worldwide. — VMJ

Toots, Heinrich. *See* Parker, Ronald B. 00569

Tourtelot, Elizabeth B. *See* Vine, James D. 00650

00648 **Tourtelot, Harry A.; Gantnier, Robert F.; Ternes, Elizabeth B.** Gold in sedimentary rocks of Tertiary age and terrace gravels east of the Black Hills and the Rocky Mountain front, South Dakota, Wyoming, and Nebraska [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 351-352, 1970.

Tourtelot, Harry A. *See* Peterman, Zell E. 00956

Towell, David G. *See* Klusman, Ronald W. 00625

Townes, W. D. *See* Fang, J. H. 08362

00649 **Trammell, John.** Stratabound base metal sulfides in the Belt Supergroup of Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 352, 1970.

00512 **Trifunac, Milhailo Dimitrije.** Investigation of strong earthquake ground motion [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 3170B, 1970.

08283 **Trojer, Felix J.** The crystal structure of a high-pressure polymorph of $CaSiO_3$ [with German abs.]: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 185-206, illus., tables, 1969.

This high-pressure phase of $CaSiO_3$ crystallizes in space group $P\bar{1}$ with following cell dimensions: a=6.695, b=9.257, c=6.666 A, α=86°30′, β=76°08 and γ=70°23′. The structure was solved by interpretation of the Patterson function. Preliminary coordinates obtained in this procedure were refined by least squares methods until the R value dropped to 6.5 percent. The basic features of this structure are irregular layers of Ca atoms which are interconnected by pairs of Ca atoms and Si_3O_9 rings which are located in the remaining space in between the layers. [Results are compared with walstromite and pseudowollastonite]. — Author's abstract

Trollman, W. M. *See* Maher, J. C. 08413

Unger, J. D. *See* Cloud, W. K. 00858

00576 **Urban, James B.; Kline, Judith K.** Chitinozoa of the Cedar City Formation, Middle Devonian of Missouri: Jour. Paleontology, v. 44, no. 1, p. 69-76, illus., 1970.

A chitinozoan assemblage consisting of five species has been recovered from the Cedar City Formation in Calloway County, Missouri. Distribution of the chitinozoans in the two sections studied indicates a definite relationship to stratigraphic and geographic location and suggests facies control of the chitinozoans. *Ancyrochitina aequoris* n. sp. and *Angochitina callowayensis* n. sp. are described and three other species of the same genera are discussed. Study by scanning electron microscope shows evidence of three wall layers commonly occurring in the fossils. — *from* Authors' abstract

00934 **Urban, James B.** Palynology of the Mineral Coal, Desmoinesian Series of Oklahoma and Kansas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 302, 1970.

00935 **Urban, James B.** Some new chitinozoans from the Cedar Valley Formation of Iowa [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 302-303, 1970.

00495 **U.S. Geological Survey.** Aeromagnetic map of parts of the Kramer and Boron quadrangles, southeastern California: U. S. Geol. Survey Geophys. Inv. Map GP-680, scale 1:62,500, 1970.

00769 **Vacher, H. Leonard.** Coarse and fine structure of the Bermuda eustatic curve — Significance to coastal plain stratigraphy [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 245, 1970.

Valdya, S. N. *See* Kennedy, G. C. 00586

08237 **vanAndel, Tjeerd H.** Recent uplift of the Mid-Atlantic Ridge south of the Vema fracture zone: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 228-230, illus., 1969.

The flat depositional floors of three inactive fracture valleys south of the Vema fracture zone are tilted markedly to the west. Core evidence strongly suggests that the sediments filling these valleys were deposited during the Pleistocene in a near-horizontal position by turbidity currents. Uplift of the currently active crest of the Mid-Atlantic Ridge is responsible for the tilting; a total uplift of 500-2000 meters is indicated by the data. — Author's abstract

00806 **VanBurkalow, Anastasia.** Memorial to Henry Dewey Thompson (1898-1967): Geol. Soc. America Proc. 1967, p. 273-275, portrait, 1970.

08380 **VanNest, J. P.; Hutchison, T. S.; Rogers, D. H.** Color centers and interstitials in X-irradiated NaCl crystals: Canadian Jour. Physics, v. 47, no. 17, p. 1797-1803, illus., 1969.

Irradiation by X-rays of NaCl crystals produces F centers and interstitial ions. The former are detected by measured changes in optical absorption, the latter by measured changes in the velocity of sound. A simple theory of dislocation pinning by interstitials accounts well for the changes in acoustic velocity. Current theories of initial-stage and final-stage coloration are justified by the results; estimates of the rates of defect production are made. — Authors' abstract

00505 **vanRyswyk, Albert Leonard.** Forest and alpine soils of south-central British Columbia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 7, p. 2993B, 1970.

Vecsey, G. E. *See* Baillie, A. D. 08232

00936 **Viele, George W.** Displacement by flow in imbricate thrust fault belts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 302-303, 1970.

00770 **Vincent, Jerry W.** Lithofacies of the Haney Limestone (Mississippian) along the eastern edge of the Illinois basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 245-246, 1970.

00650 **Vine, James D.; Tourtelot, Elizabeth B.** Hydrothermal alteration of arkosic sandstones in the Spanish Peaks region, Colorado [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 352-353, 1970.

08404 **Vine, James D.** Authigenic laumontite in arkosic rocks of Eocene age in the Spanish Peaks area, Las Animas County, Colorado, *in* Geological Survey research 1969, Chap. D: U.S. Geol. Survey Prof. Paper 650-D, p. D80-D83, 1969.

Authigenic laumontite makes up as much as 25 percent of some beds of arkosic sandstone and conglomerate in the Cuchara and Huerfano Formations of Eocene age along the south flanks of the Spanish Peaks, Las Animas County, Colo. This calcium-rich zeolite replaces the micaceous minerals of the matrix and the potassium feldspar grains of the framework in rocks that were intruded by the Spanish Peaks stocks and dikes. The full extent and chemical nature of the alteration have not yet been determined. — Author's abstract

Vitaliano, Charles J. *See* Eckerty, Donald G. 00610

00771 **Vlangas, Louis P.** On the glaciation of the Mid-Atlantic Coastal Plain [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 246, 1970.

00857 **Vogel, Thomas A.** Albite-rich domains in potash feldspar: Contr. Mineralogy and Petrology, v. 25, no. 2, p. 138-143, illus., 1970.

Detection of sodium-rich areas in orthoclase by electron microprobe analyses supports a theory for perthite formation that involves a preexsolution stage with sodium atoms clustering to form albite domains coherent with the overall lattice. Orthoclase with a heterogeneous matrix, ranging in composition from one up to 14 weight percent albite, and ranging in size from 2 to 10 microns are present in a hypabyssal nepheline syenite from Beemerville, New Jersey. These become unstable at relatively low concentrations of albite (less than 15 weight percent albite) and exsolve forming incoherent albite grains. — Author's abstract

08348 **Voight, Barry.** Evolution of North Atlantic Ocean — Relevance of rock-pressure measurements, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 955-962, illus., 1969.

Active seismicity in the St. Lawrence Valley has been taken as evidence that the area is one of active rifting, possibly connected to the world-girdling rift system. Preliminary analysis of measurements in the vicinity of this valley, however, shows a crustal stress system characterized by large horizontal compressive stresses. This pattern is typical for eastern North America, the Canadian shield, and Fennoscandia, and is not expected in an active rift system, if rift systems reflect a state of crustal extension in which lateral stresses are less than the lateral component caused by weight of overburden. It is suggested that the recent seismicity and existing stress patterns in the St. Lawrence reflect the result of glacio-isostatic activity superimposed upon mechanisms related to ocean-floor spreading, and that stress measurements may provide a useful tool for evaluation of the involved mechanisms. — *from* Author's abstract

08386 **Vondra, Carl F.; Schultz, C. Bertrand; Stout, Thompson M.** New members of the Gering Formation (Miocene) in western Nebraska, *including* A geologic map of Wildcat Ridge and related outliers *by* Carl F. Vondra: Nebraska Geol. Survey Paper 18, 18 p., illus., geol. map, 1969.

The Gering Formation, lower part of Arikaree Group here, is unconformable upon the Brule Formation but overlain conformably by the Monroe Creek Formation. It fills an ancient system of valleys, with channel sands dominant near center of each,

and is progressively more silty marginward. The formation top is marked on divides by much thinner silts, soils and volcanic ash, the Bayard Paleosol Complex, elsewhere by a new named Wildcat Ridge Ash Bed, or correlative lime-siltstone. Within the Gering is a more prominent and widespread Carter Canyon Ash Bed (new name); an unconformity 60 feet above it divides the Gering into Helvas Canyon Member, below, and Mitchell Pass Member, above, both defined in Helvas Canyon, type locality of the Gering; the Twin Sisters Pumice Conglomerate Bed (new name) is at base of the upper member. Reference sections at Mitchell Pass and Redington Gap facilitate identification of the two new members. — GDC

00772 **Voorhies, M. R.** Paleontological evidence for Pliocene age of "high-level gravels", Taylor County, Georgia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 246-247, 1970.

00651 **Wang, Charles J.** Gravity tectonics accompanying mantled gneiss domes in the Basin and Range province of Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 353, 1970.

08300 **Waggoner, E. B.; Sherard, J. L.; Clevenger, W. A.** Geologic conditions and construction claims on earth- and rock-fill dams and related structures, *in* Legal aspects of geology in engineering practice: Geol. Soc. America Eng. Geology Case Histories, no. 7, p. 33-43, illus., 1969.

The number and magnitude of disputes with contractors over claims for extra compensation in connection with earth dam construction have been increasing in recent years. Frequently, these claims are based on problems within the scope of activity of the geologist and soil engineer. A number of the more common geologic situations which have led to disputes over claims are described. Arguments are given that it would be desirable to give bidding contractors a report which describes the engineer's and geologist's interpretation of the results of the field explorations and of the probable construction problems. — Authors' abstract

08359 **Waldrop, Lyneve.** The crystal structure of triplite, $(Mn,Fe)_2FPO_4$ [with German abs.]: Zeitschr. Kristallographie, v. 130, nos. 1-3, p. 1-14, illus., tables, 1969.

The crystal structure of triplite has been determined using minimum-function methods. A three-dimensional, least-squares refinement reduced the discrepancy index R to 4.9 percent. The structure is composed of isolated PO_4 tetrahedra joined by vertices to distorted MO_4F_2 octahedra; these octahedra are linked into chains by shared edges. The chains of M(1) octahedra are parallel to b, those of M(2) octahedra parallel to a. The F atoms are distributed between two half-occupied sites, separated by 0.62 A. In this material from the Mica Lode pegmatite, Colorado, the metal atoms Mn, Fe, Mg, Ca appear to be essentially disordered between the two metal sites. —*from* Author's abstract

Walker, John L. *See* Bradshaw, Peter M. K. 08261

Wallace, Alfred T. *See* Williams, Roy E. 08367

08224 **Wallace, W. E.** Water production from abnormally pressured gas reservoirs in South Louisiana: Jour. Petroleum Technology, v. 21, August, p. 969-982, illus., 1969.

Investigation is limited to reservoirs having sandstone porosity surrounded by shale, and containing gas, condensate, and salt water; ages range from Oligocene to Miocene. Abnormally pressured reservoirs have been found in many oil and gas provinces of the world. Some sources of high pressure are: compaction of shale forcing water into sands; areas of high relief where the outcrop is high enough to cause an artesian head; and thick gas caps. Shale compaction, water influx, and volumetric reservoirs are discussed; possible mathematical models are described. The authors are convinced that it is not possible to make a reliable estimate of gas in place from production history alone. Twenty case histories from southern Louisiana are given. — ESL

Wallace, William A. *See* Bishko, Donald. 08254

00652 **Wallis, Roger H.** The Virgin River belt and the evolution of northwest Saskatchewan [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 353-354, 1970.

08291 **Walton, Dan W.** Evolution of the chiropteran scapula: Texas Jour. Sci., v. 21, no. 1, p. 85-90, illus., 1969.

Changes in the physical configuration of the chiropteran scapula have occurred which have resulted in considerable structural divergence from the form exhibited by a semi-arboreal ancestral type. These changes are visualized to have occurred in 3 basic features: a posteriorly directed rotation of the dorso-medial half of the scapula, a lateral compression of the scapula, and a shift in the direction of the face of the glenoid fossa. — Author's abstract

Walz, David H. *See* Best, David M. 00675

08264 **Wangersky, Peter J.** Distribution of suspended carbonate with depth in the ocean: Limnology and Oceanography, v. 14, no. 6, p. 929-933, illus., tables, 1969.

Depth distribution of suspended calcium carbonate was investigated in place, to determine relationship to the pH of sea water and the buffering capacity of the carbonate system. In 18 deep stations over a large area of the North Atlantic, no decrease in suspended calcium carbonate was found to depths of 5,000 m, although the sea water was undersaturated at all depths below the immediate surface layers. At least those particles of suspended calcium carbonate large enough to be collected by the filters are protected apparently by a coating of organic material from reaction with surrounding sea water. Measurements of rate constants and solubilities for the CO_2-$CaCO_3$ system may therefore be irrelevant to the situation in sea water; the governing rate in re-solution may be the rate of degradation of protective organic coatings by bacterial activity. — VMJ

Watkins, Joel S. *See* Best, David M. 00675

00653 **Wayne, William J.** Geologic studies for use in regional and local planning [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 354, 1970.

08336 **Webb, Gregory W.** Paleozoic wrench faults in Canadian Appalachians, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 754-786, illus., 1969.

A prominent system of long and generally straight faults extends from southeastern New England through western and north-central Newfoundland. A wrench-fault history is implied by the continuity, prominent shear zones, and crosscutting of major rock units by the faults. Subsidiary structures and, in places, demonstrable or implied offset of rock bodies and contacts indicate that the dominant late-phase slippage was dextral along the NE-striking faults of New Brunswick and Newfoundland and along east-striking Cobequid fault of Nova Scotia. An exception is the Harvey-Hopewell fault of New Brunswick, on which sinistral slip followed a greater dextral slip. [Movement possibly began with an early phase of sinistral motion in a late stage of the Acadian orogeny. Amounts of both sinistral and dextral movement are suggested, and palinspastic maps are presented to suggest pre-wrench position of crustal segments.]—*from* Author's abstract

08338 **Webb, Gregory W.** Paleozoic wrench faults in Canadian Appalachians — Reply to [discussion by] Brown and Helmstaedt [of 1969 paper], *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 787-788, 1969.

The fault movements in southern New Brunswick, discussed by Brown and Helmstaedt (ibid., p. 787, 1969), may possibly reflect a NW-SE principal stress unrelated to the strike-slip proposed by Webb for NE-SW faults. Moreover, large-scale strike

slip may have occurred along one or more of the NE-SW faults in southern New Brunswick without having left a lasting record. It is recognized that the feasibility of the proposed strike slip does not prove it, but evidence in other parts of the Atlantic provinces supports the hypothesis and implies extension into southern New Brunswick. — VSN

08340 **Webb, Gregory W.** Paleozoic wrench faults in Canadian Appalachians — Reply to [discussion by Brian] Lock [of 1969 paper], *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 791, 1969.

Lock's observations (ibid., p. 789-790) on faults of White Bay, Newfoundland, support Webb's thesis (ibid., p. 754-786) that wrench faulting is a significant factor in western Newfoundland. — VSN

08219 **Weeks, Lewis G.** Offshore petroleum developments and resources: Jour. Petroleum Technology, v. 21, April, p. 377-385, illus., tables, 1969.

Today hundreds of companies are exploring the shelves of 75 countries, and 9,000 to 10,000 wells have been drilled offshore. Predictions based on facts learned recently about the ocean crust would not have been taken seriously 15 years ago, and yet we know very little about the nature and source of the forces influencing the geology of the Earth. Greatest advances in knowledge are coming from seismic mapping, and drilling and coring programs. Potential petroleum resources are discussed, and advantages of offshore exploration described. Examples of offshore successes given are Venezuela, Nigeria, Australia, Persian Gulf, Alaska, and the North Sea. Ownership of offshore resources was partially worked out at the Continental Shelf Convention in 1958. Discussion is given of the task ahead for the petroleum industry, and its future in chemicals. — ESL

Weigand, Peter. *See* Justus, Philip S. 00726

00773 **Weigand, Peter W.** Major element geochemistry of the eastern North American Triassic(?) dikes [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 247, 1970.

00964 **Weill, D. F.; Bottinga, Y.** Thermodynamic analysis of quartz and cristobalite solubilities in water at saturation vapor pressure: Contr. Mineralogy and Petrology, v. 25, no. 2, p. 125-132, illus., tables, 1970.

The degree of polymerization of silica in aqueous solutions is calculated from quartz and cristobalite solubility and the free energy of the polymorphic transition. At temperatures below 130°C, the existing solubility data are not all compatible with a simple monomeric solute model. A combination of monomeric and tetrameric silica species is shown to be compatible with most of the chemical data on silica solutions. The analysis indicates that the low temperature solubilities of quartz and/or cristobalite must be more accurately defined or that the presence of polymeric silica in solution has been overlooked. — Authors' abstract

Weill, Daniel F. *See* Kudo, Albert M. 00856

00654 **Weinberg, David M.** Significance of folding in the disturbed belt, northern Big Belt Mountains, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 354-355, 1970.

08270 **Weinbrandt, R. M.; Fatt, Irving.** A scanning electron microscope study of the pore structure of sandstone: Jour. Petroleum Technology, v. 21, May, p. 543-548, illus., 1969.

The scanning electron microscope has variable magnification from 20X to 20,000X, and about 1,000 times the depth of focus of the conventional light microscope. Techniques used to make thin sections were applied to preparation of the rocks for examination. Samples studied were Boise Sandstone, Idaho, and Berea Sandstone

(graywacke), Ohio. Four photographs of the Boise, and seven of the Berea are included. Application to the network model of porous media is discussed. — ESL

00774 **Weir, G. W.; Gualtieri, J. L.** The "Rockcastle freestone," a turbidite in the upper part of the Borden Formation in southeast-central Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 247-248, 1970.

00775 **Welby, Charles W.** Observations on the origin of the North Carolina Outer Banks — Results from a geophysical study [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 248, 1970.

08294 **Wentworth, C. E.** Beach erosion control in New England: Shore and Beach, v. 37, no. 2, p. 24-30, illus., 1969.

Coastal erosion problems of New England are diversified and complex, due, in part, to the varied geologic structure of the land masses, compounded by the number and types of storms. An offshore sand inventory was completed in 1968, and restoration and creation of beaches could be accomplished from this source. Problem areas discussed are: Cliff Walk, Newport, R. I.; Gay Head Cliffs, Martha's Vineyard, Mass.; and Plum Island beach, Mass. The cliffs consist of assorted sizes of unconsolidated sands and clays underlying the terminal moraine; they were shaped by wave and stream erosion. Plum Island beach is a sandy coastal barrier bar. Wave erosion during storms creates serious problems. — ESL

08257 **Wertz, J. B.** The Arizona copper province and the Texas lineament [abs.]: Mining Eng., v. 21, no. 12, p. 64, 1969.

Wesolowski, E. A. *See* Croft, Mack G. 00602

00553 **West, Robert M.** Sequence of mammalian faunas of Eocene age in the northern Green River Basin, Wyoming: Jour. Paleontology, v. 44, no. 1, p. 142-147, illus., table, 1970.

The occurrence of fossil mammals in three fluvial units brings to five the number of early and middle Eocene mammal-producing units in the northern Green River Basin of Wyoming. Their ages range from Lost Cabin equivalent to Bridger C-D. Analysis of the taxonomic composition of these collections shows change through time as well as variation resulting from different methods of calculating the relative numbers of individuals present. These assemblages, collected both by surface prospecting and by washing, are valuable in the analysis of Eocene faunas and faunal distributions and in the interpretation of the Eocene history of the Green River Basin. — Author's abstract

00942 **West, Robert M.; Atkins, Edward G.** Additional middle Eocene (Bridgerian) mammals from Tabernacle Butte, Sublette County, Wyoming: Am. Mus. Novitates, no. 2404, 26 p., illus., tables, 1970.

Data on mammalian material collected in 1959 and 1967 are added to that previously described from the Bridger at Tabernacle Butte. Systematics and descriptions for *Phenacodus primaevus; Apatemys* sp.; *Microsyops* sp. [cf. *annectens* (Marsh, 1872)]; and *Neodiacodexis emry* Atkins, n. sp. are given. A revised list of the mammalian assemblage from the various localities at Tabernacle Butte is included. No specimens of *Phenacodus* have been reported previously from the Bridger in any of the Wyoming collecting areas. *Neodiacodexis* is the first occurrence of an artiodactyl with tritubercular molars in the Bridger. Several possible ways in which the *Phenacodus* tooth could have been introduced are reviewed, and it is concluded that the lack of previous reports reflects the fact that the genus was rare at this time. — ESL

00937 **West, Ronald R.** Biocoenoses of a Pennsylvanian strophomenid [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 303, 1970.

08246 **Weyant, Marcel.** Présence du genre *Dicoelosia* King (Brachiopode articulé) dans la Formation Cape Phillips (Silurien) de l'Archipel Arctique Canadien [with English and German abs.]: Soc. Linnéenne Normandie Bull., 10th ser., v. 9, p. 95-98, illus., 1968 [1969].

The brachiopod genus *Dicoelosia* King, a small bilobate entelectacean orthoid, is recorded for the first time from the Canadian Arctic Archipelago. The three specimens were found in a silicified fauna from a limestone layer in graptolitic shales of the Cape Phillips Formation, of Silurian (probably Llandoverian) age, on Hoved Island near the southwest shore of Ellesmere Island. The largest specimen is designated *Dicoelosia* aff. *D. alticavata*; the two smaller forms may be juvenile stages or, possibly, different species. — VMJ

08308 **Weyant, Marcel.** Conodontes ordoviciens de l'Ile Hoved (Archipel Arctique Canadian) [with English and German abs.]: Soc. Linnéenne Normandie Bull., 10th ser., v. 9, p. 20-66, illus., table, 1968 [1969].

Conodonts are recorded from a sequence of limestones of the Cornwallis and, questionably, the overlying Allen Bay Formation on Hoved Island, within Baumann Fiord of southwestern Ellesmere Island. Forty-three species, representing 22 genera, are distinguished, also three undetermined forms, of which two may not be conodonts. One new, though unnamed, species of *Ambalodus* is described. The fauna shows closer affinities with those of other parts of North America than with Europe; 18 species were recorded previously only from North America. Close relationships are shown with conodont faunas of the upper members of the Galena Dolomite of the upper Mississippi Valley and the Cobourg Formation of Ontario; these affinities suggest a late Middle or early Late Ordovician age for the limestones on Hoved Island. — VMJ

00804 **White, George W.** Memorial to Vincent Chester Shepps (1928-1967): Geol. Soc. America Proc. 1967, p. 259-261, portrait, 1970.

00833 **Whitman, Robert V.** Basic concepts and important problems, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 1-68, illus., table, 1970.

Notions of earthquake size and ground motions, earthquake response of structures, and related design criteria are reviewed in this paper. — BFG

00836 **Whitman, Robert V.** Soil-structure interaction, *in* Seismic design for nuclear power plants (Robert J. Hansen, editor): Cambridge, Mass., M.I.T. Press, p. 245-269, illus., 1970.

Models of various degrees of freedom are used to study the interaction of soil and engineering structure during an earthquake. — BFG

08346 **Whitten, E. H. Timothy.** Continental-drift models and correlation of geologic features across North Atlantic Ocean, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 919-930, illus., 1969.

Most criteria used to substantiate the concept of continental drift rely on qualitative subjective interpretation and do not yield a statistically adequate proof that drift occurred across the North Atlantic Ocean. Specific variables could be used objectively to test the continental-drift model. Preferred variables are those that could establish (1) gradients parallel with a mobile belt (e.g., vectors defined by dissimilar rates of migration of fossil genera), (2) the intracratonic nature of the Caledonian and Appalachian mobile belts, and (3) the geometric separation of intersecting mobile belts. — Author's abstract

08331 **Whittington, H. B.; Kindle, C. H.** Cambrian and Ordovician stratigraphy of western Newfoundland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 655-664, illus., table, 1969.

Cambrian and Ordovician strata crop out in western Newfoundland in a belt 5-30 mi wide extending from Port au Port Peninsula north to Cape Norman and across the tip of Great Northern Peninsula. There are two distinct facies — one autochthonous and the other allochthonous. Basal Lower Cambrian sandstones of autochthonous facies unconformably overlie Precambrian rocks, and are succeeded by dolomite and limestone of Middle Cambrian to Ordovician Whiterockian age. The allochthonous facies includes the Cow Head Group of limestone and limestone conglomerate and its lateral equivalent the Humber Arm Group, mostly clastic with some volcanic rocks, and of Middle Cambrian to Ordovician Whiterockian age. Faunal distributions in Cambrian and particularly in Ordovician do not appear to require for their explanation that the Atlantic Ocean was 'closed' during these periods. — *from* Authors' abstract

00506 **Wieluns, Robert.** The thermal behavior of wollastonite [abs.]: Dissert. Abs. International, Sec. B, Sci. and Eng., v. 30, no. 7, p. 3159B, 1970.

00976 **Wigley, Perry B.; Sergeant, Richard E.** Penecontemporaneous sedimentary structures in the Ravenna facies of the New Albany Shale [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 248-249, 1970.

Wilcox, Ray E. *See* Izett, G. A. 00622

00851 **Wildeman, Thomas R.** The distribution of Mn^{2+} in some carbonates by electron paramagnetic resonance: Chem. Geology, v. 5, no. 3, p. 167-177, illus., tables, 1970.

The results from the electron paramagnetic resonance (E.P.R.) spectra of manganese in fourteen natural and synthetic carbonate minerals show that manganese exists as Mn^{2+} in highly ionic lattice sites which are isolated in the carbonate mineral and slightly distorted from octahedral symmetry. There are two lattice sites for Mn^{2+} in dolomite and they are assigned as Mg^{2+} and Ca^{2+} substitutional sites for Mn^{2+}. The E.P.R. spectra show that the Mg-site is more populated than the Ca-site. From the results of the spectra of the Mn^{2+} in sedimentary and hydrothermally altered dolomites from the Leadville Formation of Colorado, it is found that the concentration ratio of Mn^{2+} in the Mg-site to Mn^{2+} in the Ca-site increased with alteration. — Author's summary

00938 **Wiley, Michael A.** Gravity and magnetics near the Texas lineament, Van Horn-Sierra Blanca region, Trans-Pecos, Texas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 304, 1970.

08204 **Williams, G. E.; Polach, H. A.** The evaluation of ^{14}C ages for soil carbonate from the arid zone: Earth and Planetary Sci. Letters, v. 7, no. 3, p. 240-242, illus., table, 1969.

The comparison of C-14 ages determined for pedogenic carbonate and co-existing organic carbon obtained from arid zone calcareous soils and paleosols indicates that the carbonate dates are on average at least 3600 radiocarbon years too old. This is attributed to an initial low C-14 content of soil carbonate and minimal secondary contamination by environmental C-14 within the arid zone. — Authors' abstract

08355 **Williams, Harold.** Pre-Carboniferous development of Newfoundland Appalachians, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 32-58, illus., 1969.

The Appalachian Mountains in Newfoundland comprise three geologic provinces, from west to east, the Western platform, Central Paleozoic mobile belt, and Avalon platform. Each is characterized by a different Precambrian assemblage and/or early Paleozoic depositional and structural history. Precambrian rocks underlying the western platform belong to the Grenville province of the Canadian shield; those on the east are younger and much less metamorphosed. Platform areas were sites of shallow-water, marine deposition during Cambrian and Early Ordovician, and the thin cover contrasts sharply with the thick, clastic sedimentary and volcanic rocks that accumulated in the Central Paleozoic mobile belt. Orogenic movements began

to affect the region in Ordovician time and culminated in the Acadian orogeny during Devonian. After Devonian the Newfoundland Appalachians formed a stabilized folded zone with deposition confined to a Carboniferous trough. — VSN

08367 **Williams, Roy E.; Eler, Douglas D.; Wallace, Alfred T.** Feasibility of reuse of treated wastewater for irrigation, fertilization and ground-water recharge in Idaho: Idaho Bur. Mines and Geology Pamph. 143, 110 p., illus., tables, 1969.

This study reviews the feasibility and methods of renovation of domestic and industrial waste water for use as irrigation water, to provide fertilizer for crops, to recharge ground water, and for recreation purposes and town water supply. Appropriate hydrogeologic conditions for reuse include the presence near the surface of unconsolidated porous materials, the absence of surficial, jointed rocks, and a water-table depth of at least 5 feet. In many cases renovation of waste water by percolation through vegetation and the geologic column can be substituted for tertiary treatment, and, in some cases, for secondary treatment. On the basis of soil thickness, geologic and hydrologic data, existing devices for monitoring ground water, irrigation systems, quality and quantity of waste coming from sewage treatment plants, and other factors, several towns in Idaho were surveyed for renovation of waste water and some were recommended as having a good potential. — EH

08375 **Wilson, A. C.; Sarich, V. M.** A molecular time scale for human evolution: Natl. Acad. Sci. Proc., v. 63, no. 4, p. 1088-1093, illus., table, 1969.

Quantitative comparisons of their serum albumins, transferrins, hemoglobins, and DNA show that man is genetically much more similar to the African apes than to the Old World monkeys. The amino acid sequences of hemoglobins from humans, chimpanzees, gorillas, and rhesus monkeys are consistent with the hypothesis that the probability of an animo acid substitution occurring in a given interval of time is the same for every hemoglobin lineage. This allows the use of these data as a hemoglobin evolutionary clock, just as has been done previously with the albumins. It is shown that concordance exists between the hemoglobin and albumin results and that both support the suggestion that the human lineage diverged from that leading to the African apes far more recently than is generally supposed. Considering both the albumin and hemoglobin data, the authors would set the most probable date at 4 to 5 million years. — *from* Authors' abstract

08398 **Wilson, Charles W., Jr.** Mineral resources summary of the Camden quadrangle, Tennessee:; Nashville, Tenn., Tennessee Div. Geology, 6 p., table, 1969.

This text which accompanies Tennessee Div. Geology Geol. Map GM 20-SE (Wilson, cited separately) describes the chert and gravel mined in the Camden quadrangle. Active chert pits are in the Camden and Harriman Formations; most chert is used for road surfacing. Gravel occurs in alluvium of larger streams and in older fluvial deposits. Potential resources are sand, silica, and tripoli. — MCM

08406 **Wilson, Charles W., Jr.** Geologic map of the Booneville quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 79-SW, scale 1:24,000, separate text, 1969.

The only mined mineral resource in the Booneville quadrangle is limestone; active quarries are all near Lynchburg. The Bigby-Cannon and Carters Limestones are the best sources of stone for general uses and agricultural limestone. A potential resource is chert from the Fort Payne Formation. — MCM

08412 **Wilson, Charles W., Jr.; Russell, Ernest E.** Geologic map of the Camden quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 20-SE, scale 1:24,000, separate text, 1969.

The accompanying text, "Mineral resources summary of the Camden quadrangle, Tennessee," by C. W. Wilson, Jr., is cited separately. — MCM

00776 **Wilson, Edward Norman.** Rock-stratigraphy, time significance, and geosemantics along the Mississippian-Pennsylvanian boundary in northeastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 249, 1970.

00794 **Wilson, James T.; Zumberge, James H.** Memorial to Reynolds McConnell Denning (1916-1967): Geol. Soc. America Proc. 1967, p. 193-196, portrait, 1970.

00939 **Wilson, L. R.** Palynology of Oklahoma's ten-foot coal seam [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 304-305, 1970.

00940 **Wilson, Raymond C.** Shale lubrication of the Lewis overthrust, Glacier National Park, Montana [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 305, 1970.

Wilson, William. *See* Lee, G. Fred. 08427

08345 **Windley, Brian F.** Anorthosites of southern West Greenland, *in* North Atlantic — Geology and continental drift — Internat. Conf., Gander, Newfoundland, 1967, Symposium: Am. Assoc. Petroleum Geologists Mem. 12, p. 899-915, illus., tables, 1969.

The anorthosites of southern West Greenland occur in gneisses as stratigraphic units up to 2 km wide, traceable for about 400 km. They are found in both deep and higher levels of the basement complex. In the deep-level Fiskenaesset region, chromite layering indicates that the anorthosites formed by gravitational accumulation of a basic magma, and thus contrast with the volatile-rich ilmenite- and magnetite-layered, Middle Cambrian anorthosites in the Canadian shield. An anorthosite series is postulated for Greenland beginning with early Precambrian, early magmatic bottom accumulates and ending with middle Precambrian, late plutons. Since most of the West Greenland anorthosite in the higher level areas is not chromite layered, a 'metasedimentary' origin should be ascribed with caution. — VSN

00941 **Wing, R. S.; MacDonald, H. C.; Dellwig, L. F.** Tectonic analysis from radar — Central and eastern Panama [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 305-306, 1970.

00573 **Winkler, Erhard M.** Errors in using modern stream-load data to estimate natural rates of denudation — Discussion [of paper R. H. Meade, 1969]: Geol. Soc. America Bull., v. 81, no. 3, p. 983-984, illus., 1970.

Meade's (ibid., v. 80, no. 7, p. 1265-1274) evaluation of errors is extended to include consideration of increased mineralization of natural water bodies as a result of man's activities resulting from leaching of rock, soil, stone, and concrete exposed to polluted water. The present discussion uses published material to show material increases in concentrations of Na, K, Cl, and SO_4 in Lakes Erie and Ontario, assigning anion increases to pollution and cation increase to attack of acid pollutants on rock materials. — JHF

00655 **Withington, Charles F.** Application of remote sensing to environmental geology [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 355, 1970.

00777 **Wolcott, Don E.** Interim report on the stratigraphy of part of the Breathitt Formation of eastern Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 249-250, 1970.

Wong, L. Y. *See* Anderson, A. 08408

Wood, J. A. *See* Marvin, Ursula B. 00958

Wood, Joseph M. *See* Basson, Philip W. 00972

00589 **Woodward, Lee A.** Lamprophyre dikes of Sandia Mountains and vicinity, New Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 355-356, 1970.

Workman, L. E. *See* Metherell, R. G. 08229

00590 **Wrucke, Chester T.; Theodore, Ted G.** Direction of movement of the Roberts Mountains thrust determined from folds, northern Shoshone Range and Battle Mountain, Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 5, p. 356, 1970.

00971 **Wu, Dah Cheng; Mankin, Charles J.** Clay mineralogy and geochemistry of the upper Flowerpot Shale in Major and Blaine Counties, Oklahoma [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 4, p. 306, 1970.

Wyckoff, Ralph W. G. *See* Matter, Philip, 3d. 08378

Yemel'yanov, Ye. M. *See* Barash, M. S. 00830

00778 **Yewislak, Paul P.** Geology of the Culpeper Triassic basin, Virginia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 250, 1970.

00779 **Yochelson, Ellis L.** Gastropoda and minor classes of mollusks in the Ordovician of Kentucky [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 3, p. 250, 1970.

Youance, J. *See* Colmet-Daage, F. 08358

Youd, T. L. *See* Cloud, W. K. 00858

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Geochemistry can offer help in each of the three phases of conventional petroleum exploration: assessment of overall potential of a region, selection of sites for detailed investigation, and selection of prospects to drill test. Methods outlined include age dating of basement rocks and igneous-rock systems, source-bed analyses, crude oil characterization and correlation, and hydrocarbons in surface brines. — MCM

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